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CTOBER 12, 1942
OLUME 31, No. 21

FICIAL PUBLICATION
of the
PROCEEDINGS
ERICAN ASSOCIATION
TEXTILE CHEMISTS
AND COLORISTS

AMERICAN
DYESTUFF REPORTER

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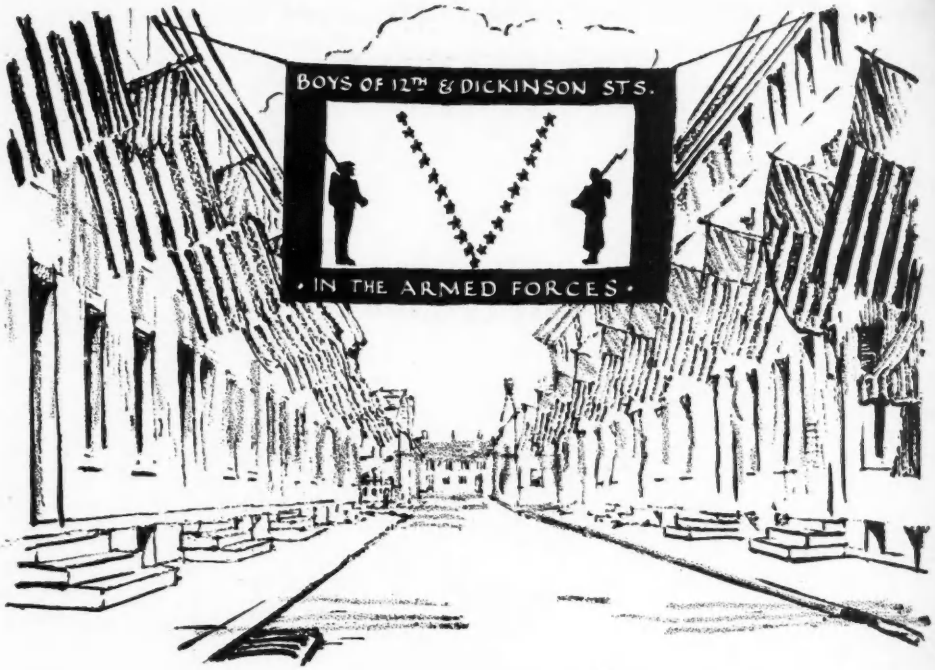

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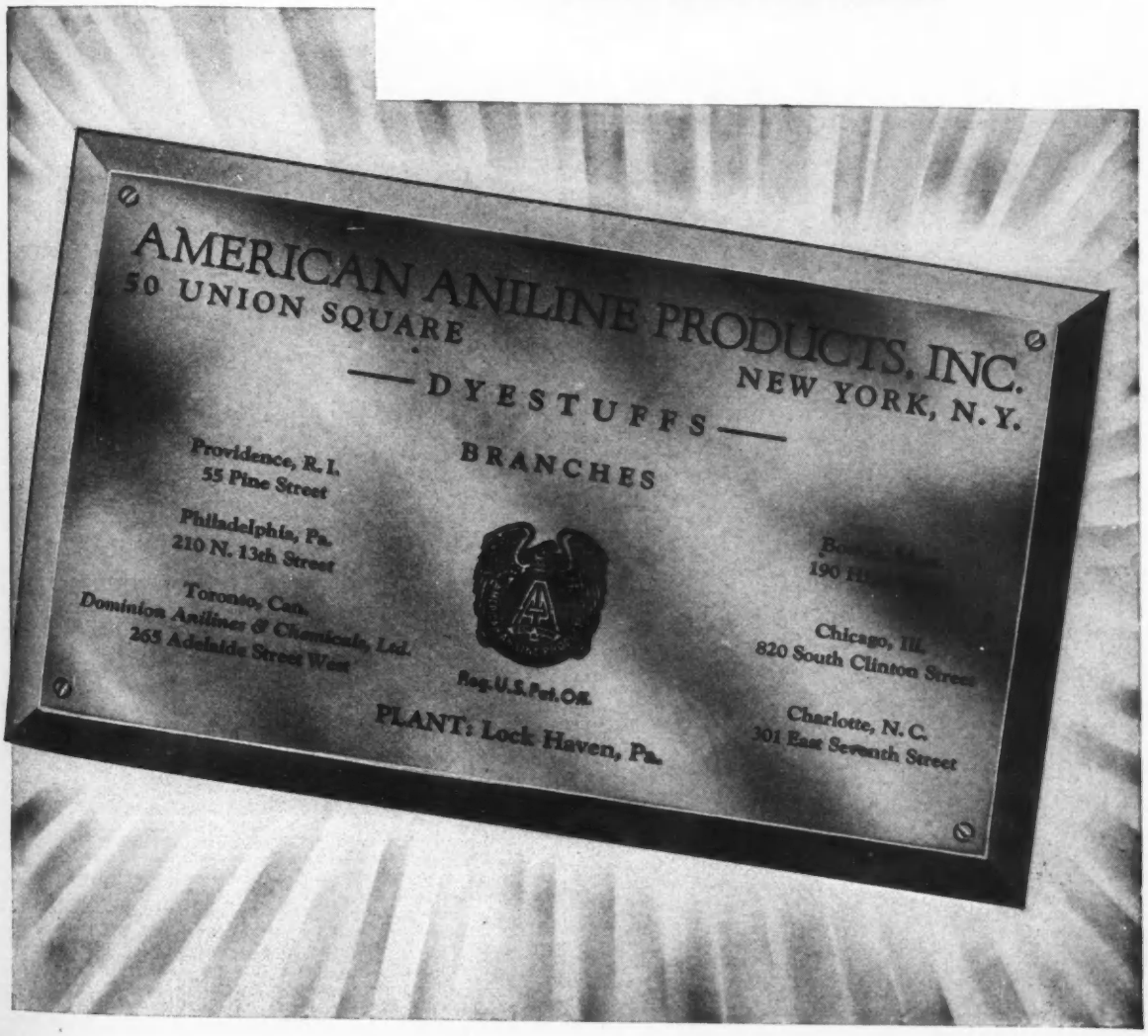

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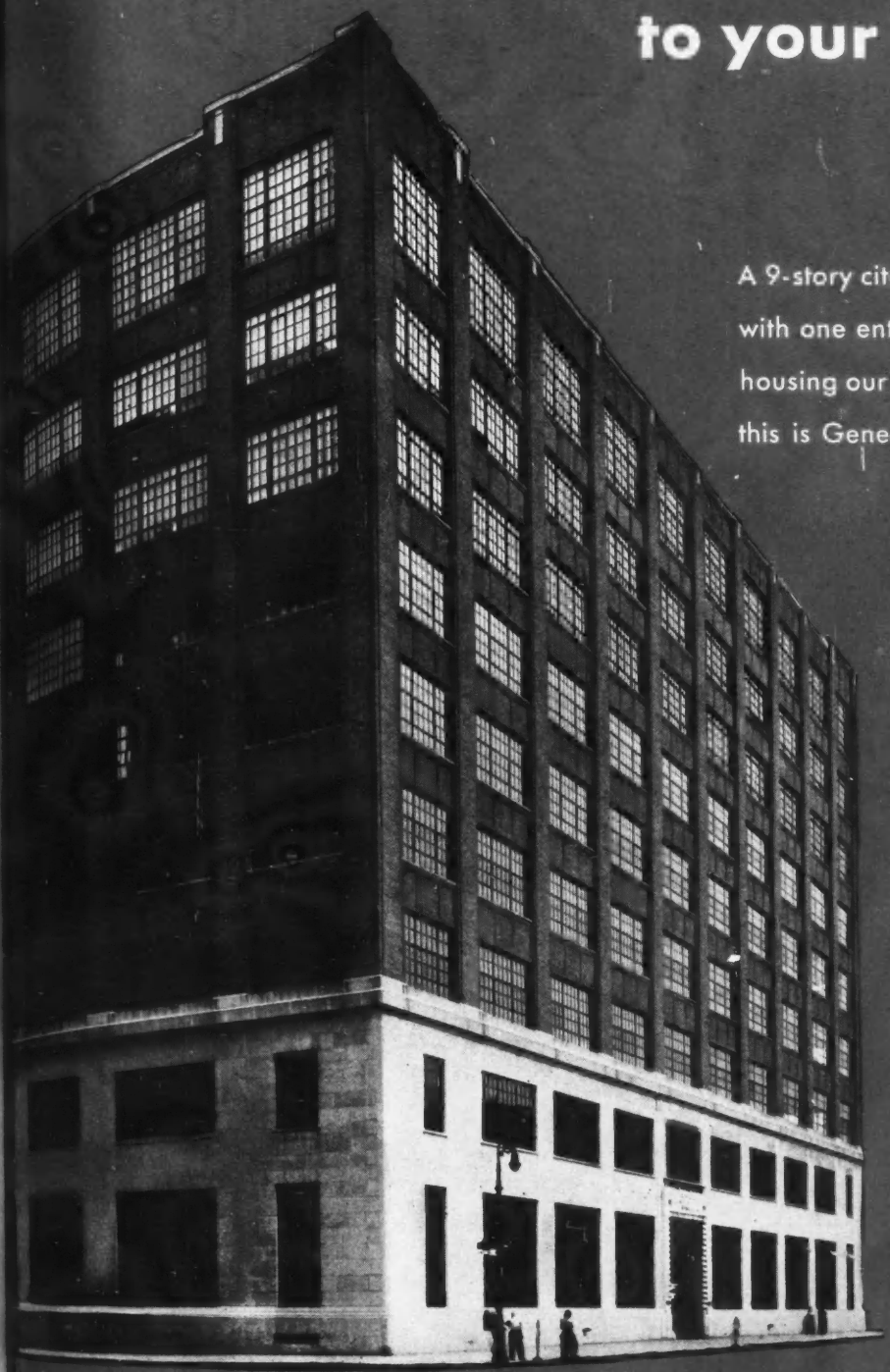

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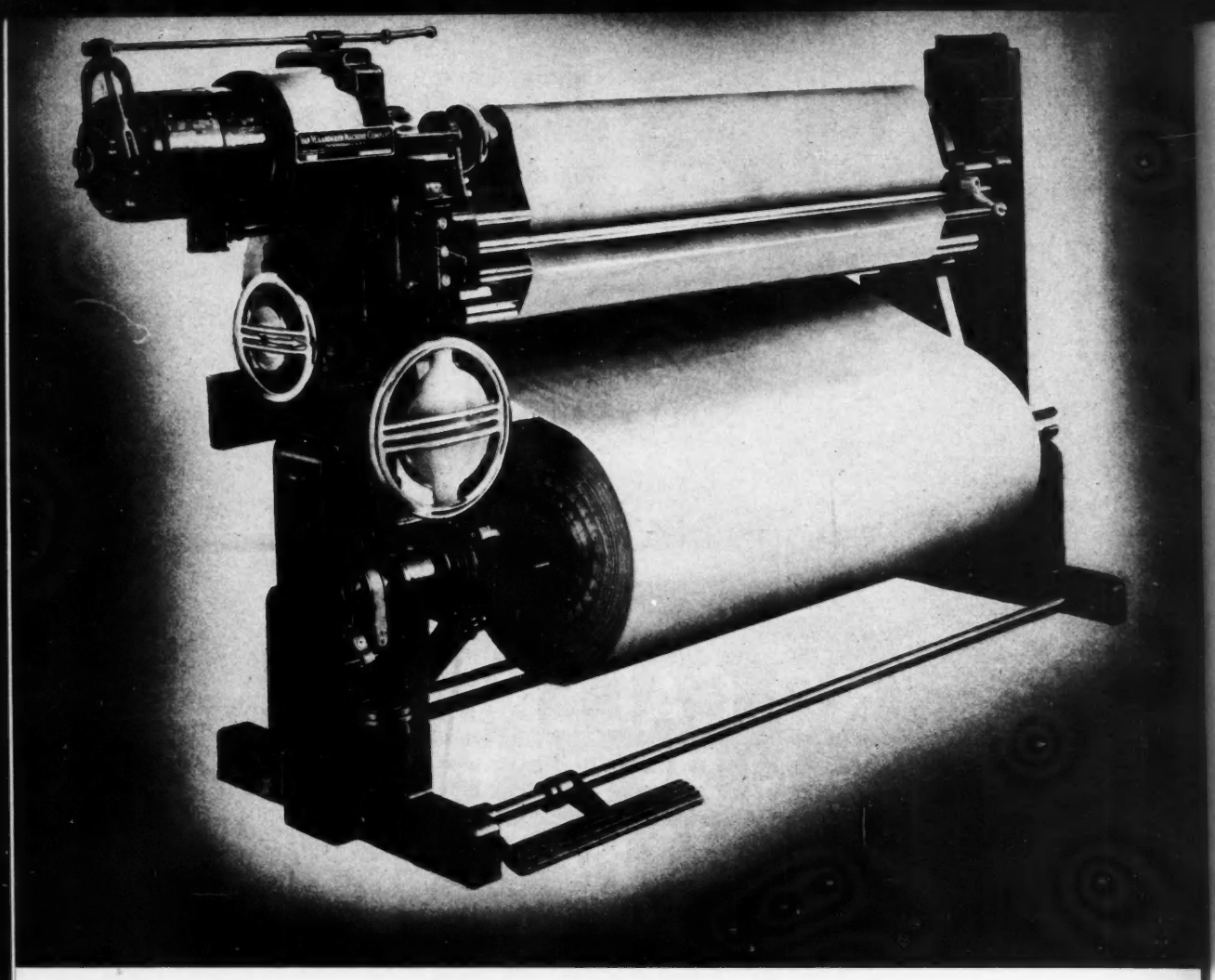

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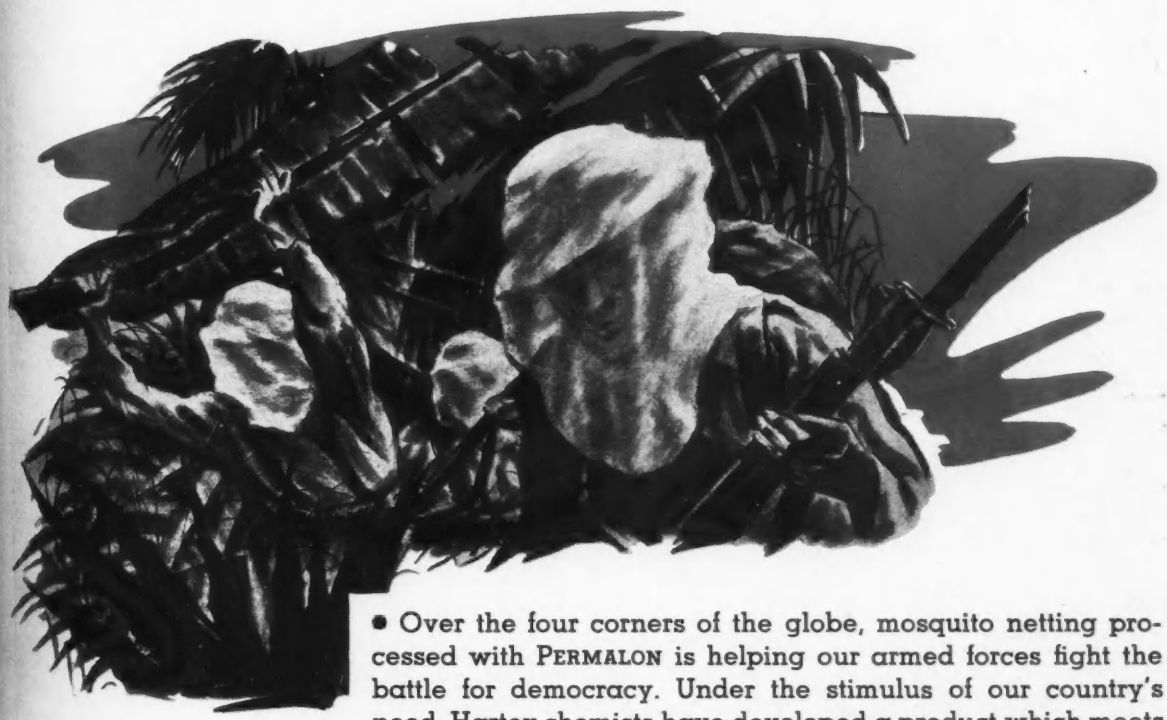

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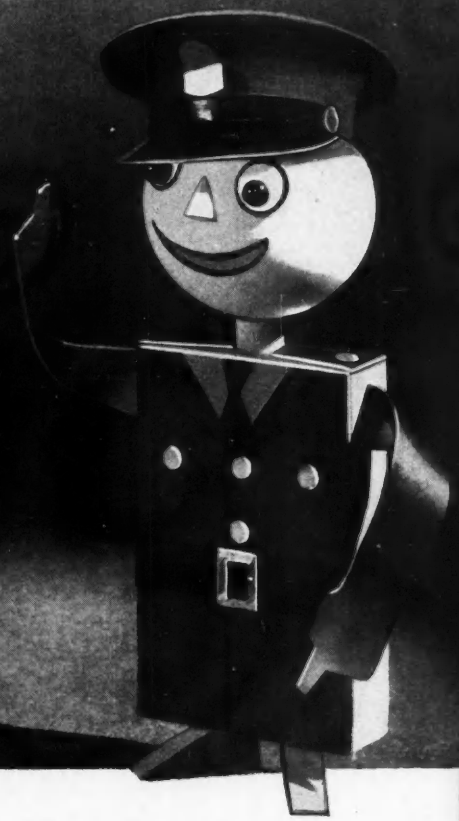

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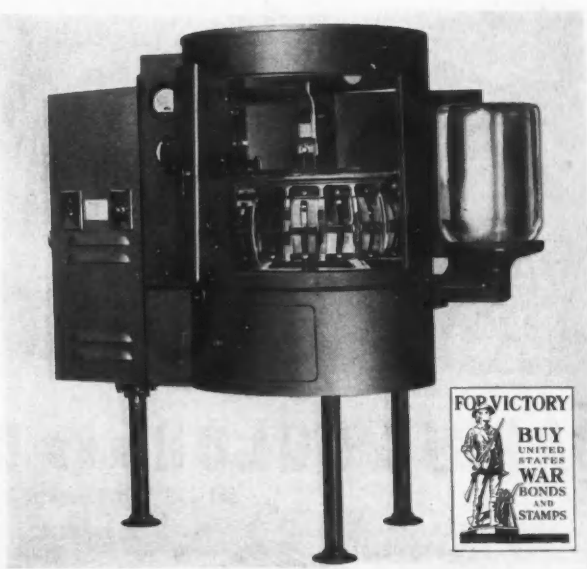

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OCTOBER 12, 1942

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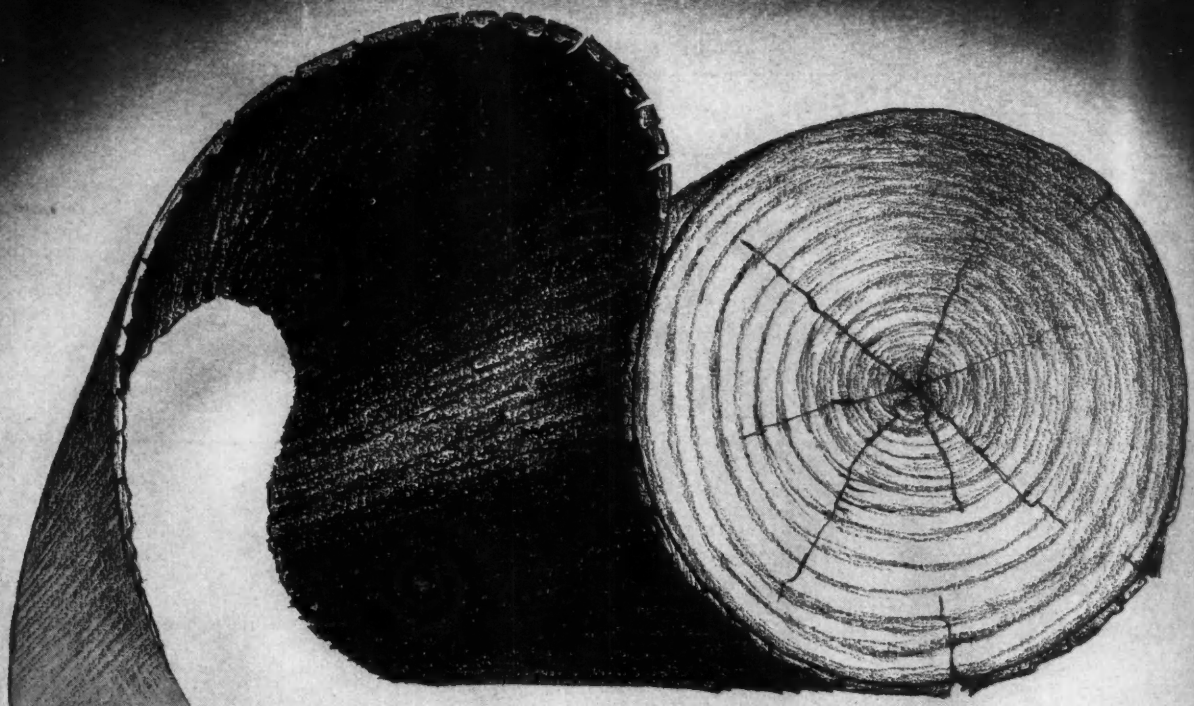

SYNTHETICS from SAWMILLS?

Fibers of California Redwood bark have long been used for cold-storage insulation. Now short, fine Redwood fibers are being mixed with wool, then carded, combed, spun and woven into cloth that simulates pure-wool fabric.

Newest example of textile research to alleviate the wool shortage, this mixture of animal and vegetable fibers is indicative of the strange combinations that will tend to complicate traditional dyehouse techniques. But whatever the fibers or fabrics of the present or the future, National Technical Service will be ready with the formulas and color stocks to give you an exact match to your fastness standard.

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AMERICAN
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VOLUME 31 OCTOBER 12, 1942 NUMBER 21

The Effect of RESIN FINISHES on the Color Fastness and Physical Properties of Rayon Gabardines

HAZEL M. FLETCHER, WILDA MARGUERITE HAY and ANDREA JEAN SURRATT

INTRODUCTION

NEW finishes, such as urea-formaldehyde resins, have fulfilled a great need of the consumer for low and medium priced fabrics that are attractive and comparatively durable. At the present time, because of the shortage of wool, silk, and linen in this country it is quite probable that the new finished rayons will replace them to a marked degreee. Resin finishes are reputed to render fabrics more color fast, to increase breaking strength, and to decrease shrinkage.

This investigation was made to ascertain the permanence of these finishes to dry cleaning and laundering and their effect on the color fastness, breaking strength, elongation, and shrinkage of rayon gabardines.

MATERIALS

The materials used in this study were viscose rayon gabardines. They were purchased from retail and wholesale stores in different localities after a preliminary test for the resin had been made upon a sample of the material. Eight rayon gabardines with a resin finish and eight without a resin finish were purchased in light and dark shades of red, blue, greeen and brown. Table I gives data concerning the physical characteristics of these materials.

*Contribution No. 108, Department of Home Economics, Kansas State College.

PROCEDURE

Identification and Determination of Finishes and Dyes

To determine the presence of urea-formaldehyde resin the method by Rath[1] was used in which a sample of the material was boiled in a distilling flask with water containing some sulfuric acid. After cooling the distillate it was introduced into a 0.1 per cent sulfuric solution of carbazole. The development of a blue color indicated the presence of formaldehyde. The identification of urea formaldehyde resin was further verified by the Skinkle method[2] in which a few crystals of phloroglucinol were added to the distillate. Upon neutralizing with sodium hydroxide, a deep red color developed if formaldehyde was present. A sample was boiled in a distillation flask with a few drops of caustic soda. When the dis-

TABLE I
Physical Characteristics of Fabrics Tested; all Fabrics 39 inches wide, with Weave (2/2)L and Z Direction of Twist

Fabric	Thread count Warp	Thread count Filling	Thickness (in.)	Weight per sq. yd. (oz. dry wt.)	Crimp per cent Warp	Crimp per cent Filling	Yarn counts (worsted dry wt.) Warp	Yarn counts (worsted dry wt.) Filling	Twist per in. Warp	Twist per in. Filling	Per cent of finish Controls	Dry-cleaned 10x	Laundered 5x
Non-resin Finished													
A, dark red	135.0	61.9	.0135	4.2	5.6	4.7	50.8	55.2	22.5	18.4	2.2	2.7	0.3
B, light red	134.4	63.1	.0150	4.2	5.3	4.7	46.4	50.4	21.7	20.4	2.8	3.3	0.2
C, light blue	133.6	62.2	.0157	4.4	4.7	6.4	47.3	54.5	20.6	19.7	2.4	3.5	0.1
D, dark blue	121.6	65.5	.0178	5.6	8.8	8.8	38.4	43.1	19.1	17.5	1.8	1.9	0.1
E, dark green	134.1	61.4	.0172	4.4	6.1	8.1	48.7	51.1	21.1	17.9	2.0	3.0	0.4
F, light green	136.7	64.8	.0158	4.4	5.5	4.8	50.1	47.9	18.3	19.5	1.4	1.8	0.3
G, dark brown	133.0	63.8	.0157	4.6	6.6	7.1	47.5	48.0	20.3	21.2	2.6	4.3	0.5
H, light brown	133.4	63.7	.0151	4.5	7.7	5.2	48.9	51.6	20.9	19.6	2.3	3.6	0.4
Resin Finished													*Laundered 10x*
I, dark red	131.0	61.0	.0154	4.9	7.3	6.8	45.6	40.7	17.7	19.1	13.7	11.9	11.4
J, light red	134.4	61.0	.0150	4.5	6.2	6.5	48.4	48.8	20.5	18.0	5.7	6.0	4.4
K, light blue	130.0	63.0	.0145	4.7	8.8	6.5	47.4	44.2	19.4	17.5	6.1	6.5	5.6
L, dark blue	121.0	63.0	.0148	4.7	6.5	7.8	46.9	45.0	20.2	18.3	6.7	7.5	5.6
M, dark green	125.0	62.0	.0142	4.6	4.6	7.4	49.0	44.0	19.8	19.1	6.9	7.8	5.6
N, light green	137.0	64.0	.0158	4.9	7.3	6.0	45.4	42.3	20.2	17.3	7.9	8.5	6.7
O, dark brown	132.0	60.0	.0148	5.2	6.1	8.6	46.4	43.7	18.1	19.7	15.2	17.2	15.1
P, light brown	131.0	62.0	.0154	4.8	6.3	4.7	45.8	38.6	19.9	19.0	13.6	13.7	13.4

tillate was introduced in the carbazole a blue color indicated the presence of urea—or thiourea—formaldehyde condensation product. Tests were made for polyacrylic and polyvinal resins by dyeing with Celliton Fast Yellow RR. Fabrics not containing such finishes were only faintly colored.

The finishing materials of the fabrics not treated with resin finishes were removed by the carbon tetrachloride and enzyme method given in A.S.T.M.[3]. The resin finish was removed by the nitric acid method of Howlett and Urquhart[4] in which a known weight of the fabric was boiled in 400 ml. of .1 N nitric acid solution for ten minutes. The per cent of finish of the controls and after laundering and dry cleaning is given in Table I.

The dyes were identified by following the tests outlined by Green and Clayton[5, 6].

Preparation of Materials

Controls were taken from all the fabrics. Each of the fabrics was divided into four equal lengths. Two lengths were laundered five and ten times, respectively, and the other two dry-cleaned five and ten times, respectively, at a commercial laundry and a dry-cleaning plant. The fabrics were laundered in tap water at 60° F. to 70° F. of zero hardness with powdered Texolive soap, a low titer cold water soap. As they came from the extractor they were ironed dry in a roller press. The fabrics were dry-cleaned in a continuous flow of the Stoddard solvent and Sanitone detergent and were pressed in a steam flat press.

Samples, one inch by six inches, of the control fabrics, fabrics laundered five and ten times and fabrics dry-cleaned five and ten times were prepared for fading by clipping to cardboard cards. The samples were subjected to light from a carbon arc lamp in the Atlas Fade-Ometer with humidity control. These fabrics before and after laundering five and ten times and dry cleaning five and ten times were subjected to light at 150° F. for 40 and 80 hours.

Analyses of color were made on samples of the fabrics before and after laundering and dry cleaning five and ten times and on fabrics before and after five and ten times laundering and dry cleaning which were exposed to fading for 40 and 80 hours at 150° F. Determinations were made for color attributes according to the Munsell system by the method described by the Bausch & Lomb Optical Company[7]. After the sector percentages of neutrals and colors were determined experimentally, the color specifications of hue, saturation (chroma), and brilliance (lightness or value) were calculated according to formulas in the catalogue[7]. Then these color specifications were reduced to one figure, the index of fading, by Nickerson's formula[8]. In this formula $I = (C/5)d2H + 6dL + 3dC$, in which I = index of fading, H = hue, L = lightness (brilliance or value), C = chroma (saturation), and d = difference.

Breaking strength, elongation and shrinkage determinations were made on the controls and after five and ten dry cleanings and five and ten launderings. Breaking strength and elongation determinations were also made on controls and dry-cleaned and laundered fabrics after they had been faded for 40 and 80 hours in the Fade-Ometer.

The breaking strength and elongation determinations were obtained by the ravel-strip method on a Scott strength tester at standard conditions according to the method outlined by Committee D-13[3]. Ten strips on the warp were prepared for the dry breaking strength; likewise ten on the warp were prepared for the wet breaking strength. Since the thread count of the samples for breaking strength varied as a result of shrinkage and abrasion, all the results of breaking strength for each material were corrected to the thread count of the dry control as follows: The breaking strength was multiplied by the thread count of the control and the product was divided by the thread count of the sample broken.

The relative wearing qualities of the fabrics were obtained by comparing the breaking strength of the original fabrics with pieces that had been abraded by a M.I.T. model abrasion tester. Strips 6 x 24 inches were abraded 500 times using a one-inch roller and crocus cloth for the abradant[2]. Strips for warp breaking strength of the controls and of fabrics laundered and dry-cleaned five and ten times were tested for abrasion.

Shrinkage was determined by comparison of measurements made before and after dry cleaning. Squares ten inches in dimension were marked off on the fabric with white cotton thread. These squares were measured after one, five and ten launderings and dry cleanings.

RESULTS

Finishes and Dyes

It was found that the carbon tetrachloride and enzyme method removed all finishes on non-resin finished fabrics but not resin finishes. The nitric acid method removed finishes on both groups. All the resin finished fabrics gave positive tests according to Rath for the presence of a urea formaldehyde condensation product on the fiber. Table I shows per cent of the finish of the resin finished fabrics on the controls and after ten launderings and dry cleanings and the per cent for non-resin finished fabrics on the controls and after five launderings and ten dry cleanings. Dry cleaning did not remove the finishing materials of either group. After the fifth laundering practically all the finish was removed from the non-resin finished group, but after ten launderings only a small amount of resin finish was removed. The greatest amount of resin finish removed by laundering was 2.3 per cent in fabric I and the less amount 0.1 per cent in fabric O.

When the fabrics were tested for the type of dye which had been used upon them, it was found that no vat dyes had been used upon either group of fabrics. This fact is of considerable interest since the eight resin finished fabrics showed a high degree of fastness to ten dry cleanings and launderings. The resin finish helped to give these fabrics a degree of fastness ordinarily attributed to vat dyes.

Statistical Analysis of Data on Fading

The data on color fastness was evaluated by the analysis

Differences in Fading of Resin and Non-resin Finished Gabardines

Source of Variation	*Differences*	*Significance*
Fabrics (resin, non-resin finished)	Non-resin finished faded more than resin finished	**
Cleanings (control, 5x, 10x dry-cleaned, 5x, 10x laundered)	Dry cleaning and laundering caused fading	***
	Differences in fading between 5x and 10x dry cleaning not significant	
	Differences in 5x and 10x laundering not significant	
	Fading due to laundering greater than that due to dry cleaning	**
Exposures (0, 40, 80 hr.)	40-hr. exposure greater than control	**
	80-hr. exposure greater than control	***
Colors (red, blue, green, brown)	Differences between colors in resin finished not significant	
	In non-resin finished brown faded the least, blue faded the most	***
		** and ***
Shades (light, dark)	Differences in resin finished not significant	
	In non-resin finished dark shades faded more	***

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

of variance[9, 10]. Using the indices of fading (I) as obtained from Nickerson's formula it was found that variances for cleanings (control, 5 and 10 dry cleanings, 5 and 10 launderings) plotted against the means of the indices for these cleanings gave a straight line. Likewise, the variances of the indices of fading for exposures (0, 40, and 80 hours) plotted against the means for the exposures gave a straight line. The correlations showed that the indices did not form a normal population. A transformation was made using $I' = \sqrt{I + .5}$. The transformed indices (I') were analyzed. Table II gives the results of the analysis of data on color fastness.

TABLE II
Analysis of Variance of Fading

Source of variation	*Degrees of freedom*	*Sum of squares*	*Mean square*	
Fabrics (resin finished, non-resin finished)	1	54.267	54.267	**
Cleanings (control, 5x, 10x dry-cleaned, 5x, 10x laundered)	4	11.522	2.880	***
Exposures (0, 40, 80 hr.)	2	66.345	33.172	***
Colors (red, blue, green, brown)	3	28.113	9.371	**
Shades (light, dark)	1	11.477	11.477	*
Interactions:				
Fabrics x cleanings	4	3.484	.871	
Fabrics x exposures	2	6.602	3.301	***
Fabrics x colors	3	12.362	4.121	***
Fabrics x shades	1	4.640	4.640	***
Cleanings x exposures	8	.764	.096	
Cleanings x colors	12	1.352	.113	
Cleanings x shades	4	.590	.148	
Exposures x colors	6	14.659	2.443	***
Exposures x shades	2	5.486	2.743	***
Colors x shades	3	3.222	1.074	*
Remainder	183	61.381	.335	
Total	231	286.266	—	

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

The "remainder mean square" was used as the error term for all interactions in Table II. The mean square derived from the pooled sum of the squares for the four interactions involving fabrics was used as the error term for fabrics. This gave a test for differences between fabrics which persisted over all launderings, fadings, colors, and shades. Likewise, the four interactions involving cleanings were pooled to obtain the error term for cleanings; the four interactions involving exposures were pooled for the error term for exposures; and also the corresponding interactions for the error term for colors and shades.

Significances of the observed differences for fading appear in Table II, showing there were significant differences for fabrics, cleanings, exposures, colors, and shades. Thus the variation due to these sources could not be attributed to chance differences during random sampling from a homogeneous population. As shown in the table there were five very highly significant interactions and one significant.

The t-test was used on the arithmetic means to test the differences in fading between specific fabrics, cleanings, etc. The results are shown at the top of this page.

Statistical Analysis of Data on Breaking Strength and Elongation

The breaking strength data and elongation data of the controls for the resin and non-resin finished fabrics are shown in Table III. The data for dry, wet, abraded and after 40 and 80 hours of exposure to light were obtained also for fabrics which have been dry-cleaned five and ten times and laundered five and ten times. These data were analyzed by the analysis of variance. Table IV gives the results of the analysis of data for breaking strength and elongation.

There were very highly significant differences in breaking strength for the two groups of fabrics; both cleanings and treatments affected the breaking strength; and all interactions were very highly significant. The differences in breaking strength between specific fabrics, cleanings and treatments as determined by the t-test are shown at the top of the following page.

For elongation very highly significant differences were found for fabrics. Treatments affected the elongation significantly, but any variation due to cleanings were chance differences. There were interactions for fabrics x treatments and cleanings x treatments. The differences in elongation between specific fabrics, cleanings and treatments as determined by the t-test are shown at the top of the following page.

Statistical Analysis of Data on Shrinking

The shrinkage for the resin and non-resin finished fabrics after ten dry cleanings and launderings is given in Table III. It was found that the variances of shrinkage

Differences in Breaking Strength of Resin and Non-resin Finished Gabardines

Source of Variation	*Differences*	*Significance*
Fabrics (resin, non-resin finished)	Resin finished greater than non-resin finished	***
Cleaning (control, 5x, 10x dry-cleaned, 5x, 10x laundered)	Differences between controls and dry cleanings not significant	
	Launderings decreased breaking strength	***
	Differences between controls, dry cleanings and launderings for resin finished not significant	
	Launderings decreased breaking strength of non-resin finished	** and ***
	Differences in resin and non-resin finished when dry-cleaned not significant	
	Resin finished greater than non-resin finished after launderings	** and ***
Treatments (dry, wet, abraded, 40 hr., 80 hr.)	Dry greater than wet for both groups	***
	No significant difference in abraded for resin and non-resin finished	
	80-hr. exposure decreased non-resin finished	**
	80-hr. exposure did not decrease resin finished	
	Wet of resin finished greater than wet of non-resin finished	**

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

Differences in Elongation of Resin and Non-resin Finished Gabardines

Source of Variation	*Differences*	*Significance*
Fabrics (resin, non-resin finished)	Non-resin finished greater than resin finished	***
Cleanings (control, 5x, 10x dry-cleaned, 5x, 10x laundered)	No significant differences between cleanings	
Treatments (dry, wet, abraded, 40-hr., 80-hr.)	Abraded less than dry of resin finished	**
	Wet greater than dry of resin finished	**
	No significant difference between dry and 80-hr. exposure of resin finished fabrics	
	80-hr. exposure less than dry of non-resin finished	***
	No significant differences between dry, wet and abraded of non-resin finished fabrics	

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

TABLE III

Breaking Strength and Elongation of Controls and Shrinkage After Ten Dry Cleanings and Launderings for Resin and Non-resin Finished Gabardines

Fabrics	*Breaking strength and standard error in pounds of warp controls*					*Elongation in per cent of warp controls*					*Shrinkage per cent after 10x dry cleanings*		*Shrinkage per cent after 10x laundering*	
non-resin finished	*dry*	*wet*	*abraded*	*40 hrs. exposure*	*80 hrs. exposure*	*dry*	*wet*	*abraded*	*40 hrs. exposure*	*80 hrs. exposure*	*warp*	*filling*	*warp*	*filling*
A, dark red	87.8 ± 0.5	40.4 ± 1.6	50.9 ± 3.2	77.2 ± 0.7	67.5 ± 1.6	23.3	23.7	17.7	22.0	19.7	3.0	1.0	10.0	1.5
B, light red	78.4 ± 0.6	28.9 ± 1.0	53.2 ± 0.9	71.6 ± 0.6	61.2 ± 1.0	22.7	21.0	17.3	22.0	20.7	5.0	2.0	8.0	1.0
C, light blue	85.4 ± 1.0	37.0 ± 1.6	76.9 ± 1.2	75.7 ± 0.7	67.4 ± 0.9	22.0	21.7	23.7	20.7	20.0	3.0	2.5	8.0	2.5
D, dark blue	94.5 ± 1.9	49.8 ± 1.0	81.6 ± 0.9	84.2 ± 1.0	71.9 ± 1.8	26.0	27.3	22.7	21.3	20.3	3.5	—2.0*	14.0	0.0
E, dark green	72.5 ± 0.6	28.0 ± 0.9	56.2 ± 1.7	62.7 ± 1.3	52.8 ± 0.3	21.3	21.0	19.3	22.0	19.0	3.5	0.0	8.0	1.0
F, light green	79.6 ± 1.1	40.5 ± 0.9	63.5 ± 2.3	68.2 ± 1.0	56.0 ± 1.7	20.0	23.3	18.7	20.3	18.0	3.5	1.0	13.0	3.0
G, dark brown	80.6 ± 0.9	36.5 ± 1.1	67.2 ± 1.8	71.5 ± 1.2	61.2 ± 1.5	23.7	25.7	21.7	24.7	20.7	4.5	0.5	10.0	1.0
H, light brown	89.2 ± 0.8	45.3 ± 0.4	71.0 ± 3.7	79.2 ± 0.6	71.6 ± 1.1	23.7	26.3	20.7	24.7	21.7	4.0	2.5	10.0	2.0
Resin Finished														
I, dark red	98.2 ± 1.2	53.4 ± 0.5	46.0 ± 2.1	88.0 ± 0.5	87.6 ± 1.1	10.7	16.7	7.7	13.3	12.3	3.5	—1.5*	3.0	—1.0*
J, light red	102.0 ± 0.9	60.3± 1.2	74.9 ± 1.7	92.3 ± 0.9	87.9 ± 1.0	17.3	20.7	15.0	16.3	17.0	1.0	0.0	1.5	0.0
K, light blue	105.1 ± 1.0	59.8 ± 1.5	83.4 ± 1.0	96.9 ± 1.4	98.2 ± 0.7	15.3	22.0	15.7	17.0	17.0	2.5	—0.5*	4.0	0.0
L, dark blue	96.0 ± 0.6	55.6 ± 2.8	59.6 ± 1.6	92.8 ± 1.1	91.2 ± 0.8	19.0	22.0	12.7	16.7	18.7	1.5	0.0	2.0	0.0
M, dark green	90.4 ± 0.8	52.4 ± 0.6	64.2 ± 1.4	86.7 ± 0.9	85.6 ± 1.4	16.7	19.7	12.3	15.7	14.0	2.5	1.0	5.0	0.0
N, light green	100.1 ± 1.0	63.9 ± 3.1	59.7 ± 1.4	99.2 ± 1.3	96.4 ± 1.1	20.0	23.7	14.7	19.0	17.3	1.0	0.0	0.5	0.0
O, dark brown	100.9 ± 0.8	60.4 ± 0.7	74.4 ± 1.2	102.6 ± 1.1	102.7 ± 1.0	12.0	15.7	8.7	11.0	11.7	2.0	0.0	1.5	0.0
P, light brown	90.6 ± 0.4	51.6 ± 0.4	79.7 ± 1.7	90.6 ± 1.2	91.9 ± 0.6	13.3	15.3	13.0	12.3	13.3	2.0	0.0	2.0	1.0

*Stretch.

for the various cleanings (control, 5 and 10 dry-cleanings, 5 and 10 launderings) plotted against the means for these cleanings gave a curve. This curvilinear correlation was broken up by the transformation of $S' = \log (S + 3)$ where S is the percent shrinkage and S′ is the transformed number. The Naperian logarithms were used in this transformation. Table V gives the results of the analysis of the transformed data for shrinkage.

The two groups of fabrics differed in shrinkage. Both laundering and dry cleaning caused shrinkage in both resin and non-resin treated fabrics as shown by the data in Table III. However, the differences in shrinkage between cleanings (1, 5, 10 dry cleanings and 1, 5, 10 launderings) were not important. The shrinkage in the warp was much

TABLE IV

Analysis of Variance of Breaking Strength and Elongation

Source of variation	Degrees of freedom	Mean square: Breaking strength	Mean square: Elongation
Fabrics (resin finished, non-resin finished	1	31049.9 ***	4252.34 ***
Cleanings (control, 5x, 10x dry-cleaned, 5x, 10x laundered)	4	1938.9 **	56.2
Treatments (dry, wet, abraded, 40 and 80 hr. exposures)	4	22996.0 ***	155.9 **
Interactions:			
Fabrics x cleanings	4	788.4 ***	11.24
Fabrics x treatments	4	1264.9 ***	93.01 ***
Cleanings x treatments	16	141.3 ***	15.42 **
Colors within fabrics	14	723.9 ***	33.42 ***
Remainder	352	31.3	5.96
Total	399	—	—

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

TABLE V

Analysis of Variance of Shrinkage

Source of variation	Degrees of freedom	Mean square
Fabrics (resin finished, non-resin finished	1	9.1298 **
Cleanings (1x, 5x, 10x, dry-cleaned, 1x, 5x, 10x laundered)	5	.7487
Warp vs. filling	1	15.8068 ***
Interactions:		
Fabrics x cleanings	5	.2930 ***
Fabrics x warp vs. filling	1	.6003 **
Cleanings x warp vs. filling	5	.1880 **
Remainder	173	.0608
Total	191	—

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

greater than in the filling. Interactions were found for fabrics x cleanings, fabrics x warp vs. filling and cleanings x warp vs. filling. The differences in shrinkage between specific fabrics, cleanings and dry cleanings are shown at the bottom of this page.

CONCLUSION

The resin finished fabrics had a firmer handle than the non-resin finished and had a better appearance after cleaning. Dry cleaning did not greatly affect the appearance of either group, but both were somewht changed by laundering. The non-resin finished gabardines became sleazy on laundering and some of them showed considerable yarn slippage after abrasion.

The statistical analysis of the data showed significant differences in the color fastness and the physical properties favoring the resin finished over non-resin finished gabardines.

The fading of the non-resin finished fabrics was greater than the resin finished by a highly significant amount. Both laundering and dry cleaning caused very highly significant differences in fading, and fading due to laundering was greater than that due to dry cleaning. There were no significant differences of fading in the colors or in the light and dark shades of the resin finished fabrics. In the non-resin finished fabrics the browns and the light shades faded the least.

There is excellent reason to believe, from this research, that the resin finished gabardines were definitely stronger than those gabardines without resin finish. Dry cleanings did not affect the breaking strength of either group. Launderings decreased the breaking strength of the non-resin finished but not of the resin finished fabrics. There was a very highly significant difference between the dry and wet breaking strength of both fabrics with the dry material the stronger. The resin finish increased the wet breaking strength but did not increase its resistance to abrasion. Exposures of 80 hours to light decreased the breaking strength of non-resin finished but not of the resin finished.

The elongation of the non-resin finished fabrics was greater than the resin finished by a very highly significant amount. Neither dry cleanings nor launderings affected the elongation. The abraded elongation was less and the wet was greater than the dry in the resin finished but not in the non-resin finished. The elongation of the non-resin finished fabrics decreased on exposure to light.

The resin finished shrank less than the non-resin by a highly significant amount. In case of the resin finished fabrics there were no significant differences in the shrinkage for the dry cleanings and launderings. However, the shrinkage due to laundering was significantly greater than that due to dry cleaning for the non-resin finished fabrics. The shrinkage in the warp was significantly greater than in the filling for the resin finished and highly significantly greater for the non-resin finished.

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Differences in Shrinkage of Resin and Non-resin Finished Gabardines

Source of Variation	Differences	Significance
Fabrics (resin, non-resin finished)	Resin finished less than non-resin finished	**
Cleanings	No significant difference between the dry cleanings and launderings for resin finished	
(1x, 5x, 10x dry-cleaned) (1x, 5x, 10x laundered)	Launderings greater than dry cleanings for non-resin finished	*
Warp vs. filling	Warp greater than filling for resin finished	*
	Warp greater than filling for non-resin finished	**

*Significant (variation exceeded 5 per cent level).
**Highly significant (variation exceeded 1 per cent level).
***Very highly significant (variation exceeded 0.1 per cent level).

ACID DYEING AND ANIMALIZING

of Cellulosic and Synthetic Fibers

THE properties of the animal fibers are so remarkable in some respects that they have been deemed worthy of a great deal of investigation in attempts to imitate these properties on fibers which are inferior in these respects. Silk for instance has luster, crease-resisting properties and an affinity for very bright dyestuffs e.g. basics and acids. Wool has warmth, crease-resisting properties and affinity for dyes similar to silk. It is evident that very beautiful fabrics can be made from fibers possessing such properties and that successful attempts at imitation in any respect are well worthwhile. The following notes will be in the nature of an attempt to assess in some measure the degree of progress that has been made in the direction of these aims.

A brief summary of the constitution and properties of silk and wool may serve at this juncture to emphasize the objects in view. The chemical composition of both fibers is very complex and varies greatly within the species from which the fibers are derived. Silk consists of carbon, hydrogen, oxygen and nitrogen while wool has sulfur in addition to these. Both fibers show the properties of amino acids and exhibit somewhat similar affinities for dyestuffs particularly acids and basics, while they also show strong affinity for metallic hydrates. There are, however, very considerable differences in dyeing and printing procedure. For instance the affinity of silk for dyestuffs is rather less than that of wool; on the other hand, while silk dyes very well from cold baths, wool dyes very little. Again from hot dyebaths the wool has much greater affinity for dyestuffs than silk. Apart from their complex chemical constitution the physical properties of these fibers impart to them many of their most pleasing attributes of handle and appearance. Taking both together, chemical and physical, the sum of their excellence lies in the fact that they are protein or in another phrase animal fibers.

Naturally the attention of dyers was first drawn to the fact of this more than ordinary affinity for dyestuffs possessed by these fibers and it was probaby considered that if the substances embodied in the animal fibers which exhibited this affinity could be isolated and successfully synthetized a similar affinity could be imparted to other fibers of vegetable origin. Knecht in fact in 1888 obtained a light brown solution from wool by treating the purified fiber with sulfuric acid which gave precipitates when added to solutions of acid dyes. The amount of this substance which was capable of thus forming color lakes was found to be 25-30 per cent of the wool. From such early conjectures and experiments arose the desire and the stimulus to pursue the subject further and bring about what has been termed the animalizing, or sometimes the basifying, of other types of fiber, e.g., cotton and regenerated fibers. At first the main object would seem to have been the production of an affinity for acid dyestuffs and this object has always been kept in the forefront, latterly however the other properties of animal fibers, in particular crease-resistance, have come in for a great deal of attention. In the very latest field of textile research, namely that of the production of the new synthetic fibers, all the valuable properties of the animal fibers have been seemingly kept in view and some very striking results achieved. So far as affinity for acid dyestuffs is concerned, it is undoubtedly a very great advantage to have the color range on the cellulosic type of fiber extended, particularly in the realm of the production of brighter colors. The value of the other properties imparted is obvious. To take the whole field of discussion in one view it might be stated that the relationship between all the fibers mentioned is based on a protein-like content inherent or imparted.

From the present point of view a few notes on the proteins may be of interest. Proteins constitute the chief element in animal cells and are present to a large extent in vegetable structure, especially in seeds and grain from which they are in turn assimilated by animals with little or no change in structure during the process. Generally they are insoluble in water, alcohol and ether but many of them are soluble in salt solutions. All are colloidal bodies some of which are easily coagulable under the influence of heat, individuals exhibiting variation in respect of temperature. Other members of the series coagulate in the presence of alcohol and in some instances under the influence of mineral acids. All of them contain carbon, hydrogen, oxygen, nitrogen and sulfur. Casein is a phospho protein containing phosphorus in addition to other elements and is acidic in character.

The relationship between acid dyes and the animal fibers has been elucidated first of all as a chemical phenomenon whereby reaction takes place between the basic groups of the fibers and the color acid anions of the dye. Another view is that dyeing is a process of adsorption of the color acids by the protein fibers from aqueous solutions of the dyes.

In the conferring of acid dyeing properties on other than animal fibers the use of proteins in various forms is resorted to. The problem in each case is to find the most suitable form of protein for application to a particular

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CALENDAR OF COMING EVENTS

Meeting, Northern New England Section, October 23, 1942. Speaker: Dr. Ernst A. Hauser, Massachusetts Institute of Technology, will discuss "Rubber."

Meeting, New York Section, November 6, 1942, Downtown Athletic Club, New York, N. Y. Speaker: Dr. Arnold Lippert of W.P.B. will discuss Conservation Order M-103.

Meeting, Philadelphia Section, December 4, 1942.

Physical Methods for Evaluating the HAND OF FABRICS and for Determining the Effects of Certain TEXTILE FINISHING PROCESSES*

EDWIN C. DREBY**

ABSTRACT

Of eight physical properties of a fabric appreciated by the sense of touch, three proved to be the most important characteristics contributing to the "hand" or "feel" of soft finished fabrics. These are flexibility, surface friction and compressibility. The Planoflex, Friction-Meter and Compression-Meter were developed for the evaluation of these respective properties. It was shown that these three properties were associated with the components of hand termed "pliability," "smoothness" and "fullness' and that they permitted the quantitative specification of hand. The Planoflex, Friction-Meter and Compression-Meter are sensitive to small differences in finish and in addition to their use in evaluating hand they can be used to evaluate the effectiveness of different finishing agents, to control finishing processes and to evaluate the effects of other factors affecting the hand of fabrics. The instruments are rugged and practical making them suitable for routine textile testing. They are satisfactory for the measurement of all soft finished woven fabrics.

INTRODUCTION

THE marketability of textiles for clothing, household, and other uses depends in no small degree upon those characteristics of the finish of the goods which are judged by the sense of touch. The importance of the "hand" or "feel" of textiles to manufacturers of finishing agents, to textile finishers, and to distributors of textiles led three years ago to the establishment, under the auspices of Committee D-13 of the American Society for Testing Materials, of a research associate at the National Bureau of Standards for the development of methods for evaluating textile finishes. Three instruments, the Planoflex, the Friction-Meter and the Compression-Meter, were developed for measuring the flexibility, surface friction and compressibility, respectively, of fabrics. It is the purpose of this paper to outline briefly the several applications of these instruments.

The problem of hand is not a simple one for there are at least eight physical properties of cloth which affect the judgment of hand and which cannot be distinguished from one another in judging hand. They are listed in Table 1 with a phrase which describes each property qualitatively and with terms which have been selected for use in describing the range of the corresponding components of the hand. This list was prepared jointly by the Special

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TABLE 1

Proposed Terms to be Used in Naming the Physical Properties of Fabrics Related to Hand and for Describing the Corresponding Components of Hand

Physical Property	*Explanatory Phrase*	*Terms to be Used in Describing the Range of the Corresponding Component of Hand*
1. Flexibility	Ease of bending	Pliable (high) to stiff (low).
2. Compressibility	Ease of squeezing	Soft (high) to hard (low).
3. Extensibility	Ease of stretching	Stretchy (high) to non-stretchy (low).
4. Resilience	Ability to recover from deformation in which rate of recovery is without limits and thus includes elasticity (instantaneous recovery).	Springy (high) to limp (low). Resilience may be flexural, compressional, extensional, or torsional.
5. Density	Weight per unit volume (based upon A.S.T.M. standard measurement of thickness and fabric weight).	Compact (high) to open (low).
6. Surface Contour	Divergence of the surface from planeness.	Rough (high) to smooth (low).
7. Surface Friction	Resistance to slipping offered by the surface.	Harsh high) to slippery (low).
8. Thermal Character	Apparent difference in temperature of the fabric and the skin of the observer touching it.	Cool (high) to warm (low).

Committee for Testing of Textile Finishes of Committee D-13, A.S.T.M., and the Committee on Crease Resistance and Permanency of Finishes of the American Association of Textile Chemists and Colorists.[1] The words chosen to represent the physical properties and their corresponding elements of hand were selected to be perhaps the least ambiguous or objectionable of the several that could be used. The purpose of this list is two-fold: to arouse a consciously directed effort on the part of textile experts toward analyzing their appreciation of hand into components corresponding to physical properties and to establish a standard vocabulary for describing the hand of all fabrics, thereby clarifying the confusion that exists in this field.

Three of the properties listed: namely, flexibility, surface friction, and compressibility, proved to be the most important characteristics of the soft finished fabrics to which the work was largely devoted. Since the methods already available for evaluating these characteristics of the fabrics were found to be lacking in sensitivity or were tedious and time consuming, it became necessary to develop new tests. They will be described briefly.

PLANOFLEX

The essential requirement of a flexibility measurement was met by using the Planoflex[2], shown in Figure 1, since

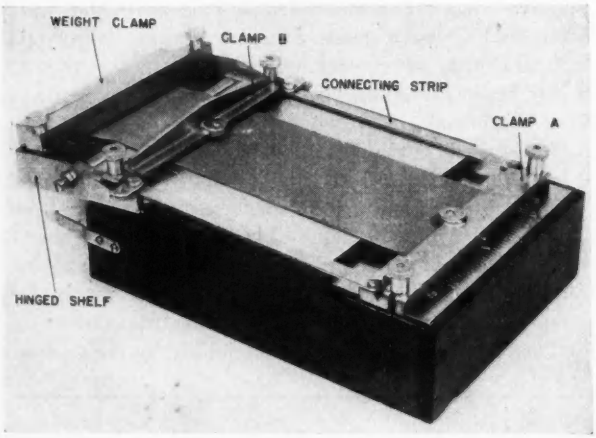


Fig. 1

the results obtained correlated with tactual ratings of "pliability" even though the specimen is not subjected to simple bending. The Planoflex consists of a base plate, mounted on a wooden frame, to which are attached two clamps, one moveable, A, and the other fixed B, and a hinged shelf. Clamp A is constrained by two connecting strips to move in an arc of 6-inch radius such that it is at all times parallel to clamp B. A weight clamp, supported by the hinged shelf, is used to put the test specimen under a 2-pound tension when it is mounted.

A specimen three inches wide and ten inches long, cut with the long dimension parallel to either the warp or filling yarns of the fabric, is used for the test. One end of the test specimen is fastened centrally in the weight clamp. The other end is fastened in clamp A, after which the shelf is released, subjecting the specimen to a tension of two pounds. Clamp B is tightened and the specimen is ready for test. Clamp A is moved slowly first to the left and then to the right to the angles at which wrinkles first appear on the surface of the cloth. These angles, in degrees, are read on the scale below the pointer on Clamp A. The total angle through which the fabric can be distorted in this manner is the sum of the readings obtained on the left and on the right of the center. The precision with which the wrinkles can be observed is demonstrated by the photographs in Figure 2 of a specimen at three different stages of the test.

The measurement is simple, the instrument is rugged, the large area of specimen used in the test gives very reliable and reproducible results, for most woven fabrics approximately the same angle is observed whether the specimen is cut in the warpwise or fillingwise direction, the instrument is direct reading, and the results obtained indicate the detection of smaller differences than can be appreciated by the hands. Measurements in triplicate, including all operations except conditioning of the specimens, can be made in about five minutes, a factor that is of considerable practical importance.

FRICTION-METER

The Friction-Meter, shown in Figure 3, was developed to evaluate the coefficient of kinetic friction between the surface of a fabric and some other standard surface. For the purposes of this problem, the coefficient of friction between two surfaces of the same fabric was found to be satisfactory.

Two specimens approximately 3½ by 10 inches, with the long dimension in either the warpwise or fillingwise direction, are used for the test. One specimen is placed face up on the table and one end is fastened in a clamp on the drum. The other specimen is placed face down on top of the former and one end is fastened in the clamp on the torsion element. A 1-pound weight, having an area of 10 square inches, is put on top of the two specimens. The lower specimen is drawn uniformly from under the upper specimen by turning the crank. The frictional force between the sliding surfaces of the fabric specimens causes a deflection of the torsion element, which is essentially a torsion spring with a 2-inch lever arm. The deflection is indicated on a dial gauge, the scale of which is graduated to read the coefficient of kinetic friction directly. At the beginning of the motion a high value is observed, corresponding to the coefficient of static friction, which falls off to a steady value as the motion is continued. The latter value, obtained at a speed of 2½ feet per minute, is the one recorded.

The measurement is simple, the instrument is so constructed that the torsion element cannot be damaged by an accidental knock, the results are reproducible, the in-

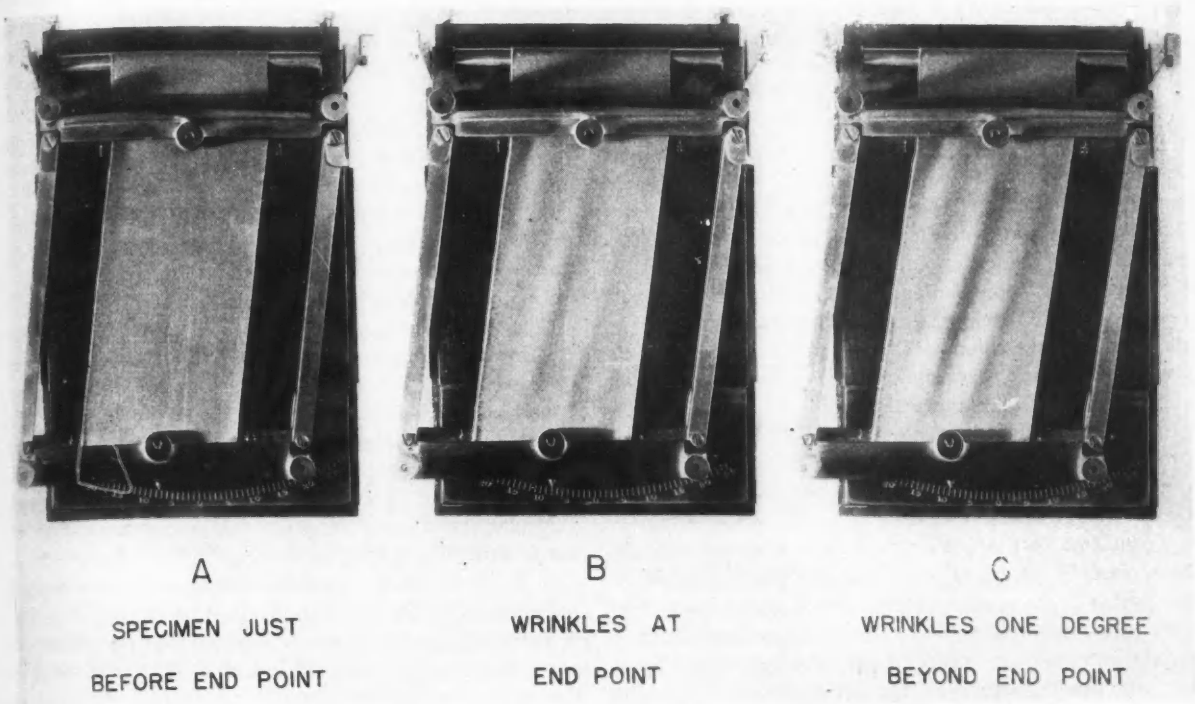


Fig. 2

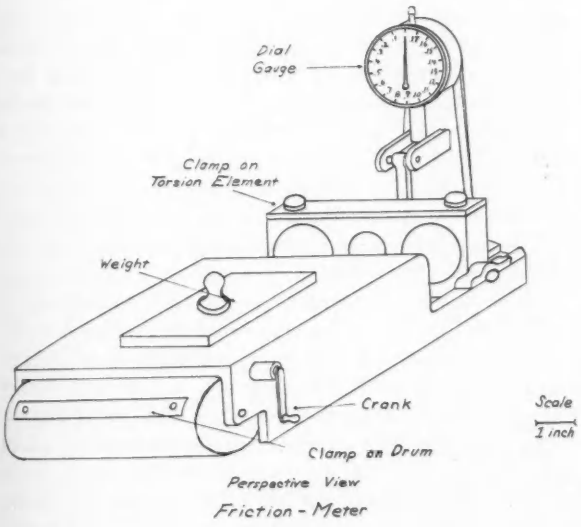


Fig. 3

strument is sensitive to very small differences and it is direct reading. Measurements in duplicate, including all operations except conditioning of the specimens, can be made in about five minutes.

COMPRESSION-METER

The Compression-Meter, shown in Figure 4, was developed to evaluate the compressibility of fabrics. The instrument contains a cavity bounded on the bottom of the

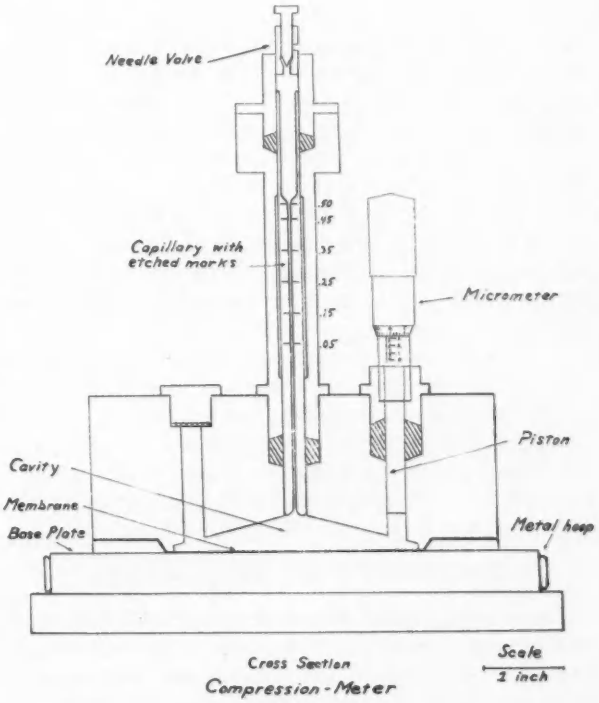


Fig. 4

instrument by a rubber membrane 3 inches in diameter and approximately 0.004 inch thick. The bottom surface

of the membrane is flush with the bottom surface of the apparatus. The cavity is filled completely with water. A glass capillary tube of 0.1 centimeter internal diameter, the top of which widens into an enlarged space which can be closed with a needle valve, is connected with the cavity. A piston, operated by a graduated screw micrometer, controls the volume of the cavity, thus regulating the liquid level in the capillary tube and the pressure at the membrane surface. When, under the prescribed conditions of use, the liquid level is brought to each of the marks indicated on the capillary tube, the test specimen is subjected to pressure of 0.5, 0.15, 0.25, 0.35, 0.45, and 0.50 pound per square inch respectively. These pressures are produced in part by the weight of the column of liquid and in part by the increase in pressure, over atmospheric pressure, of the air enclosed in the space above the capillary. The Compression-Meter is hinged to a metal base plate which has provision for securing a test specimen over its surface. In use the Compression-Meter is clamped to the base plate by three toggle bolts.

To make a test, a fabric specimen is clamped over the base plate by means of a 4-inch diameter metal hoop. Variations in the tension do not have an appreciable effect upon the measured values. The Compression-Meter is swung into place and clamped over the specimen. Then, with the needle valve open, the liquid level is adjusted to the 0.05 pressure level by turning the micrometer. The needle valve is closed and, again by turning the micrometer, the pressure is increased on the fabric. The micrometer readings, in inches, at the various pressure levels are observed. The difference in the micrometer readings for a pair of pressure conditions, i.e., the micrometer displacement in inches, is proportional to the change in volume of the fabric produced by the change in pressure. This quantity when divided by the thickness of the fabric is proportional to the average compressibility of the fabric for this range of pressure conditions. A similar quantity, for the recovery of the fabric from load, when divided by the former can be used for evaluating compressional resilience.

The Compression-Meter, while not as rugged as the other instruments, has two advantages over other devices for evaluating compressibility. It is sensitive at very low pressures. The membrane surface permits a uniform pressure distribution over a large area. Measurements in duplicate, including all operations except conditioning of the specimens, can be made in about ten minutes.

SENSITIVITY OF INSTRUMENTS

The sensitivities of these instruments to small differences in finish were studied by measuring a series of fabrics which were prepared by treating separate portions of an 80 x 80 cotton fabric with different small amounts of each of three commercial softening agents. The results showed first that each of the three instruments measured consistent variations in the properties of these fabrics corresponding to the different amounts of the softening agents applied, secondly that the differences between the measured results of pairs of fabrics treated with different amounts of the same softening agent were generally greater than the average variation of all observed values from their mean value for any one fabric, and thirdly that the measured values indicated the differences in the hand of these fabrics as determined by averaging the ratings of hand given independently by four textile experts. These observations indicate the reliability, sensitivity and significance of the results obtained with the instruments.

TACTUAL EVALUATION

The tactual evaluation of hand is a psychological process involving a mental reaction to stimuli induced by the physical properties of the fabric coupled with previous experience in handling fabrics. Generally speaking, by tactual means, it is not possible to make an evaluation of one of the fabric's physical properties without being influenced by the effect of other properties. So the three principal tactual qualities of a fabric contributing to its hand, termed by textile experts "pliability," "smoothness" and "fullness," cannot be associated with any one physical property. Pliability of hand is the least complex quality. A flexibility measurement is adequate for its evaluation. Smoothness of hand is quite complex. The more flexible, the more compressible and the lower the coefficient of kinetic friction, the smoother a fabric feels in the hands. Fullness is also complex. The more compressible and at the same time the less flexible a fabric, the fuller it feels in the hands. It will be observed that the terms "pliability," "smoothness" and "fullness" describe complex qualities of hand and that they should not be confused with the terms in Figure 1 for describing tactual evaluations of individual physical characteristics of a fabric. The results of an extensive study on eighteen 80 x 80 cotton percales will illustrate the significance of the above conclusions.

The relative order of the eighteen percales from the most pliable to the stiffest was determined independently by each of eight textile men experienced in handling fabrics of this type. The average of the individual relative ratings for each fabric was taken to represent each fabric's relative pliability. In the same way an average relative fullness rating and an average relative smoothness rating were determined for each fabric. In addition the fabrics were further rated as to their desirability for use as a dress fabric from the standpoint of their overall characteristics of hand.

COMPARISON OF TACTUAL AND INSTRUMENTAL EVALUATION

In Table 2 the eighteen percales, designated by the letters A to R inclusive, are arranged in order from the most pliable to the stiffest as determined by their average relative pliability ratings. The results of their measurement with the Planoflex are also included in the table. By a statistical method described by Kendall[3] the degree of correlation between the ranking of these fabrics by the

TABLE 2

Distortion Angle of 80x80 Cotton Percales and Their Pliability of Hand

Fabric Designation	*Average Relative Pliability Rating*	*Planoflex Distortion Angle in Degrees*
A	1.9	12.3
B	3.9	12.0
C	4.1	11.3
D	4.5	10.8
E	4.5	10.5
F	5.4	8.5
G	6.6	10.3
H	8.4	16.8
I	8.9	8.5
J	11.2	6.5
K	11.4	7.0
L	12.4	11.5
M	14.5	4.3
N	15.2	3.0
O	15.5	6.5
P	15.5	3.8
Q	17.6	1.8
R	18.3	4.0

Kendall Correlation Coefficient ..... 70% indicating the agreement between the ranking of these fabrics by Planoflex values and their ranking by tactual evaluations of pliability.

TABLE 3

Coefficient of Kinetic Friction of 80x80 Cotton Percales and Their Smoothness of Hand

Fabric Designation	*Smoothness Rating Average Relative*	*Friction-Meter Coefficient of Kinetic Friction*
D	3.5	0.49
J	3.7	.49
N	3.8	.39
Q	5.0	.39
O	5.9	.45
A	6.8	.53
G	7.1	.35
C	7.7	.46
K	8.7	.42
I	9.4	.45
P	10.1	.40
M	11.9	.43
R	12.9	.46
L	14.0	.53
E	14.9	.50
F	15.5	.51
H	16.9	.60
B	17.7	.55

Kendall Correlation Coefficient..... 44% indicating the agreement between the ranking of these fabrics by Friction-Meter values and their ranking by tactual evaluations of smoothness.

tactual and the Planoflex method of evaluating pliability was determined. The coefficient of correlation obtained (70 per cent) indicated that the Planoflex method gave results that had a highly significant relation to the fabrics' pliability.* An examination of Table 2 shows that fabrics H and L were the ones that differed most in the two series. Two other methods for evaluating pliability, the Schiefer Flexometer method[4] and the Pierce Hanging-Heart Loop method[5], also indicated the same relative displacement of these two fabrics with respect to the others in the series. No explanation has been found to account for the discrepancy between the tactual ranking and the instrumental rankings of these fabrics.

In Table 3 the eighteen percales are arranged in order from the smoothest to the roughest as determined by their average relative smoothness ratings. The results of their measurement on the Friction-Meter are also included in the table. The Kendall method showed a significant correlation (44 per cent) between the ranking of the percales by their coefficients of friction and their average relative smoothness ratings. If factors other than the coefficient of friction did not affect the evaluation of smoothness, the correlation coefficient would be higher. Additional studies indicated that the more pliable a fabric the smoother it felt and the more compressible a fabric the smoother it felt. Both of these characteristics permit the fabric to conform more readily to the contour of the fingers as the fabric is drawn through them and they seem to reduce pressure stimuli that give a feeling of roughness. No precise method of evaluating their relative effects on smoothness has been determined however. While such a method would be highly desirable, the lack of one does not prevent the overall evaluation of hand as shown later.

In Table 4 the eighteen percales are arranged in order from the fullest to the least full as determined by their average relative fullness ratings. The results of their measurement on the Compression-Meter and their thickness, measured under a pressure of one pound per square inch, are also included in the figure. The Compression-Meter value, which is the micrometer displacement in inches, when divided by the thickness, gives a quantity proportional to the compressibility of the specimen. These quantities are not given in the figure since the Compression-Meter value itself, a function of both compressibility and thickness, is more useful in evaluating hand. The Kendall method showed a lack of correlation (12 per cent) between Compression-Meter values and average relative fullness ratings. The Compression-Meter value did indicate, however, a characteristic appreciated by the hands; namely, "thinness" or "thickness" of hand. This characteristic is not to be confused with the physical dimensions of the fabric for as the results in the figure show the impression of "thickness" is not related so much to the physical thickness of the specimen as it is to its compressional characteristics. The explanation seems to be that a compressible fabric piles up against the fingers as it is drawn through them and creates the impression of "thickness." The compressional characteristics, which in themselves showed no correlation with fullness, were not without effect, however, on the fullness of hand. The Compression-Meter values when divided by the respective Planoflex values gave quantities that were highly significantly related (Kendall correlation

*According to accepted statistical standards, values of the Kendall correlation coefficient, for the ranking of 18 items, have the following significance: 34 per cent, borderline significance; 43 per cent, significant; 50 per cent, very significant; and above 50 per cent, highly significant.

TABLE 4
Compression-Meter Values of 80x80 Cotton Percales and Their Fullness of Hand

Fabric Designation	*Average Fullness Rating*	*Thinness of Hand*	*Compression-Meter Value* Inches*	*Thickness Inches*	*Planoflex Distortion Angle*	*Compression-Meter Value Planoflex Value*
R	3.1		0.061	0.0078	4.0	0.0153
P	5.0		.057	.0074	3.8	.0150
N	5.1	thin	.048	.0070	3.0	.0160
O	5.2	thin	.050	.0076	6.5	.0070
Q	5.5	thin	.052	.0064	1.8	.0289
J	7.7		.061	.0075	6.5	.0094
M	8.7	thin	.054	.0075	4.3	.0126
I	10.4		.058	.0081	8.5	.0068
L	10.4		.066	.0076	11.5	.0057
K	10.6	thin	.042	.0082	7.0	.0060
D	11.2	thin	.053	.0078	10.8	.0049
G	11.4	thin	.047	.0077	10.3	.0046
E	12.2		.065	.0090	10.5	.0062
C	12.9		.063	.0083	11.3	.0056
A	13.1		.061	.0081	12.3	.0050
F	14.5	thin	.042	.0073	8.5	.0049
H	14.9	thin	.057	.0080	16.8	.0034
B	16.3		.037	.0072	12.0	.0031
Kendall Correlation Coefficient.....			12%		66%	76%

indicating the agreement between the ranking of these fabrics by several measured quantities and their ranking by tactual evaluations of fullness.

*The Compression-Meter values listed are the micrometer displacements, in inches, necessary to change the pressure on the fabric from 0.05 to 0.45 pound per square inch.

coefficient of 76 per cent) to the average fullness ratings. Thus the more compressible, the thicker, and at the same time the less flexible a fabric, the fuller it will feel in the hands.

OVER-ALL EVALUATION OF DRESS FABRICS

The foregoing illustrates how certain physical properties of a fabric affect its components of hand. In practice, however, it is the over-all effect in the hand that determines the fabric's desirability and while one fabric may have characteristics that make it very desirable for one purpose, the same characteristics make it very undesirable for another. The eighteen percales were rated for desirability as dress fabrics. They were classified as good, fair and poor. In Table 5 the Planoflex, Friction-Meter and Compression-Meter data are plotted to show the distribution of values and their relationship to desirability of hand. It was found that the graph could be divided into certain regions associated with different degrees of desirability. Thus all the percales having a Planoflex value greater than 6.0, a Friction-Meter value greater than 0.48 and a Compression-Meter value greater than 0.057 had a good hand for use as a dress fabric. From this it is seen that irrespective of the way the measured properties affect separate components of hand, the three measurements together enable the quantitative specification of the hand of a fabric.

TABLE 5
Relation of Hand to Measured Properties of 80 x 80 Cotton Percales.

Other investigations that further substantiated the practicability and the suitability of using flexibility, surface friction and compressibility measurements for defining the hand, and in particular the use of the Planoflex, Friction-Meter and the Compression-Meter for these measurements, were made on a wide variety of fabrics. These included cotton print cloths, broadcloths, poplins, organdies, twills, and sateens; rayon french crepes, twills, satins, and spun rayon fabrics both of a linen-like and a challis-like finish; and wool and mixed wool-rayon uniform suitings and shirtings. Each of the three instruments is limited in its use in that results are only comparable on similarly constructed fabrics. This is not a serious limitation, since hand itself is relative and for the most part only similarly constructed fabrics are compared.

OTHER USES FOR THE INSTRUMENTS

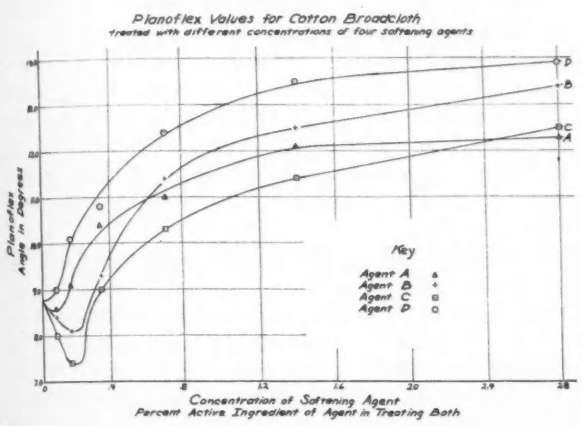
Since hand is a characteristic of a fabric acquired by the additive effects of numerous textile finishing processes, it is obvious that sensitive instruments such as the Planoflex, Friction-Meter and Compression-Meter may be used not only for studying the effects of unit processes on the physical properties of fabrics and consequently on their hand but also for controlling these processes so as to produce or reproduce desired characteristics in a finished fabric. Several groups of finished fabrics with known differences in treatment have been measured. A discussion of the results obtained will illustrate the various uses of these instruments.

EVALUATION OF FINISHING AGENTS

The application of finishing agents to improve and change the hand of fabrics is one of the more important processes in the finishing of textiles. The use of the Planoflex, Friction-Meter and Compression-Meter for evaluating the effectiveness of finishing agents is illustrated by the results of measurements on the following three sets of fabrics.

A group of 100 x 60 cotton broadcloths treated with different concentrations of each of four softening agents were measured with the Planoflex. The data are shown in graphical form in Table 6. It is to be noted that three of these agents have a slight stiffening effect at very low concentrations and that the rate of increase in pliability with an increase in concentration of the finishing agent falls off rapidly beyond an effective concentration of 1 per cent. The value of such data in comparing the relative effectiveness of different finishing agents and in determining the optimum concentration of a finishing agent are obvious.

TABLE 6



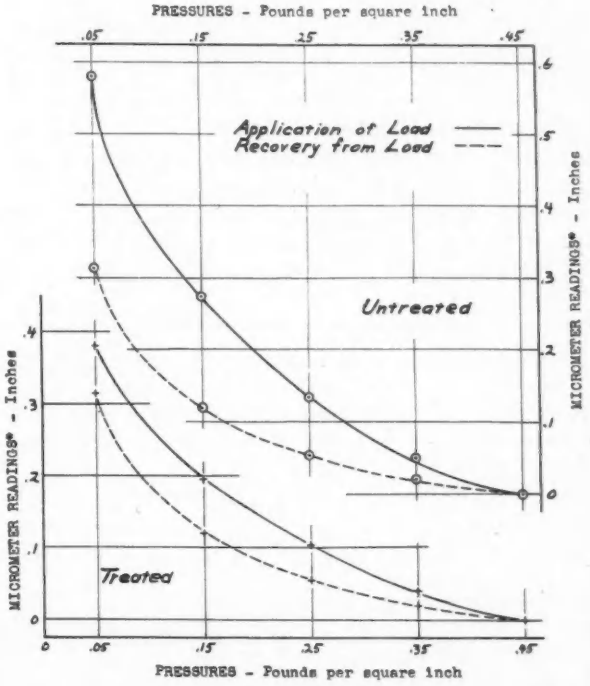
Certain finishing agents have a relatively large effect on the surface characteristics of fabrics. The effectiveness of such finishing agents is readily evaluated with the Friction-Meter. An example is the application of delustering agents to silk hosiery. An untreated silk stocking had a coefficient of kinetic friction of 0.30. Various softening agents and body imparting agents had little effect on the coefficient of friction, resulting in values between 0.28 and 0.32. A delustering agent, however, resulted in a coefficient of kinetic friction of 0.50. For other stockings, treated with small amounts of the delustering agent together with other softening and body imparting agents the coefficients of friction were between 0.34 and 0.36. Other fabrics, particularly rayon satins and twills, showed a similar relation between lustre and surface friction, indicating the application of the Friction-Meter for the quantitative evaluation of these effects.

A pair of spun rayon twills, one untreated and the other treated with a crease resistant finish, were measured with the Compression-Meter. The data are shown in graphical form in Table 7. The solid lines indicate the change in volume of the fabric as pressure is applied. The steeper slope of the curve for the untreated specimen shows it to be more compressible than the treated specimen. The dotted lines indicate the recovery of the fabric from compression as the pressure is removed. The ratio of the energy recovered after compression to the energy expended during compression is a measure of the compressional resilience. Qualitatively, the curves show that the recovery of the treated specimen is much greater in proportion to its compression than the untreated, indicating its greater resiliency. By actual computation of the compressional resilience the treated fabric has a resiliency of 62 per cent and the untreated a resiliency of 43 per cent.

TABLE 7

COMPRESSION METER VALUES FOR A SPUN RAYON TWILL

Comparison of a crease-resistant finished fabric with the original untreated fabric



* The difference in the Micrometer Readings for any pair of pressure conditions is proportional to the change in volume of the fabric produced by the change in pressure. The proportionality constant is the cross-section area of the piston operated by the screw micrometer.

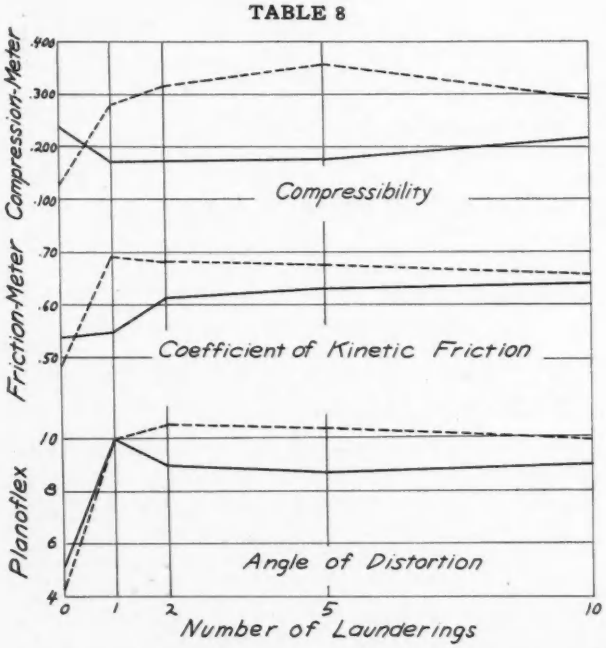
EVALUATION OF FINISHING PROCESSES

Different processes or conditions to which fabrics are subjected in manufacture or in use such as calendering, laundering and variations in relative humidity affect the physical properties of a fabric to a large extent as shown by the results of measurements on the following groups of fabrics.

A pair of 68 x 72 cotton print cloths, one plain finished and the other calendered, were measured with the Planoflex, Friction-Meter and Compression-Meter. The calendering process changed the Planoflex value from 19.4 to 10.2, the Friction-Meter value from 0.64 to 0.55 and the Compression-Meter value from 0.046 to 0.034. These indicate considerable reductions in flexibility, surface friction and compressibility. One instrument, say the Planoflex because of its greater sensitivity and simplicity, would be sufficient to give a quantitative measure of the extent of the calendering process.

A pair of cotton sheetings, one treated originally with a regular starch finish and the other treated with a semi-permanent finish, were subjected to ten launderings. Measurements were made with the three instruments before laundering and after the 1st, 2nd, 5th, and 10th launderings. The data are shown in graphical form in Table 8. It is

TABLE 8



Effect of Laundering on Cotton Sheeting

evident that not only the degree of retention of the finishing agent after laundering may be studied but also in what physical respects the fabrics have changed.

A pair of 68 x 72 cotton print cloths, separate portions of which were conditioned in atmospheres of 40 per cent, 50 per cent and 65 per cent relative humidity were measured with the three instruments in these respective atmospheres. The data are given in Table 9. An increase in the relative

TABLE 9
Effect of Moisture Content on 68x72 Print Cloths

Relative Humidity	*Planoflex Distortion Angle Degrees*	*Friction-Meter Coef. of Friction*	*Compression-Meter Micrometer Displacement Inches*
Plain-finished 68x72 cotton print cloth			
40%	14.9	0.81	0.165
50%	18.5	.80	.150
65%	19.4	.72	.135
Calender-finish 68x72 cotton print cloth			
40%	6.8	.66	.120
50%	9.1	.65	.110
65%	10.0	.60	.110

humidity with the consequent increase in the moisture content of the fabric specimens resulted in increased flexibility, decreased surface friction and decreased compressibility. These data indicate not only the variation of the hand of a fabric with a variation of its moisture content but also the necessity, when comparing the hand of different fabrics, of evaluating their hand under similar conditions of relative humidity.

Still another example of interest is illustrated by the effect of fiber composition on the physical properties of the fabric. An all wool and three mixed wool-rayon uniform suitings, all of identical construction, were measured with the three instruments. The data are given in Table 10. They illustrate how hand is affected by the fiber composi-

TABLE 10
Effect of Fiber Composition on Uniform Suitings

Composition	*Planoflex Distortion Angle Degrees*	*Friction-Meter Coef. of Friction*	*Compression-Meter Micrometer Displacement Inches*
100% wool	16.0	0.98	0.283
70% wool—30% viscose	11.3	.89	.198
50% Wool—50% viscose	11.2	.65	.186
50% Wool—50% acetate	13.0	.86	.221

tion of a fabric and the application of the Planoflex, Friction-Meter and Compression-Meter for giving a quantitative measure of such effects.

REFERENCES

[1]Terms Relating to the "Hand" of Fabrics. (American Dyestuff Reporter, vol. 29, page 560, 1940.)

[2]Dreby, E. C., "The Planoflex, a simple device for evaluating the pliability of fabrics." (N.B.S. Journal of Research, vol. 27, page 469, 1941.)

[3]E. R. Schwarz and L. J. Winn, "Technical Evaluation of Textile Finishing Treatments. III—Use of Rank Correlation for Comparison of Data." (American Dyestuff Reporter, vol. 29, p. 40, 1940.)

[4]H. F. Schiefer "The Flexometer, an instrument for evaluating the flexural properties of cloth and similar materials." (Journal of Research, N. B. Standards, vol. 10, page 647, 1933.)

[5]F. T. Pierce, "The Handle of Cloth as a Measureable Quantity." (J. Textile Institute, vol. 21, page T377, 1930.)

REPRINTS ON MILDEWPROOFING

A FEW reprints of the Textile Foundation paper by Charles W. Hock, on the "Mildewproofing of Military Fabrics" are available from the office of the Textile Research Institute, Inc., 10 East 40th Street, New York, N. Y.

MEETING, NEW YORK SECTION

THE first meeting of the New York Section for the 1942-43 season was held on October 2nd at the Chemists' Club in New York.

Emmett J. Driscoll, chairman of the technical program committee, reported that the next meeting would be held at the Downtown Athletic Club in New York City on November 6th, and that Dr. Arnold Lippert of the W.P.B. would discuss recent conservation order M-103. Mr. Driscoll also referred to the plans being made for other future meetings.

The chairman, P. J. Kennedy, announced that a membership committee had been formed with Thomas F. O'Brien as chairman. The chairman also called attention to the meeting of the Philadelphia Section on October 9th at which the Intersectional Contest papers would be presented. He announced that P. J. Wood would read the paper for the New York Section.

Leonard Little reported that a committee on corporate memberships was in process of formation.

The speaker of the evening was Earle M. Edgerton, director of the technical control department of Pacific Mills, who discussed "Causes and Effects of the Proposed Federal Trade Commission Color Fastness Rules." Due to the timeliness of the subject and the authoritative presentation of the speaker a most valuable evening resulted. There was considerable discussion.

Among the guests at this meeting were: Miss Katherine Fisher, Director of Good Housekeeping Institute; Lt. Cmdr. W. F. Prien, U. S. N. and Lt. Cmdr. D. W. Twigg, U. S. N.

Attendance was about 120.

Respectfully submitted,

NORMAN A. JOHNSON, *Secretary.*

MEMBERSHIP

APPLICATION BLANKS

for individual

and corporate

MEMBERSHIP

may be obtained

from the Secretary of the Association

DR. H. C. CHAPIN

Lowell Textile Institute, Lowell, Mass.

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the American Dyestuff Reporter any vacancies which may occur in their business.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

NOTICE TO EMPLOYERS

Personal Histories and Employment Records of the following applicants are on file at the office of the American Dyestuff Reporter. Prospective employers may examine them without obligation.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-2

Education—B.T.C., Lowell Textile Institute, 1933.

Experience—Textile chemist, cotton and rayon thread; agricultural chemist, protein, fat and mineral analysis; special Federal inspector on textiles, New York City; U. S. inspector, war department; chemist-spotter, dry cleaning experience. Age 32; married.

A-3

Education—B.S. in chemistry, Lehigh University.

Experience—Experimental engineer and analytical chemist, 8 mos.; assistant superintendent of silk corporation, assisted in planning and directing production, in charge of laboratory, technical work, personnel, purchasing, etc., 2 years; inspector of ordnance material, to the present. Seeks position as chemical engineer or chemist.

Age 25; single; references.

A-B-9

Education—Textile School Graduate; Alexander Hamilton Institute Business Course.

Experience—Mature, executive type of textile chemist and colorist with over twenty years' broad general experience in factory, laboratory, purchasing and all around business procedure. Good correspondent. Excellent personality. Wholesome appearance. Fine speaker. Literary and artistic ability. Real color sense. Possesses fund of factual information about material things in a wide range of industries. Capable of meeting the highest type of clientele and planning and directing the efforts of all types of personnel. Desires supervisory, contact, promotional or sales work. Willing to prove ability and versatility.

Age 44; American born; New England Yankee ancestry; married.

A-B-18

Education—Graduate Philadelphia Textile School, 1940.

Experience—Has experience as assistant chemist and trouble shooter in silk dyeing and finishing plant; as manager of laundry store; and as printer and colorist in screen printing plant. Seeks position in laboratory and research, dyeing, printing or finishing.

Age 21; single; references.

A-B-C-F-3

Experience—Broad experience since 1906 as overseer of finishing, general researcher, trouble shooter, overseer of dyeing, general superintendent, mill manager. Experienced in woolen, worsted, cottons, unions and mixtures. Recently specialized in men's wear cottons. Seeks position as overseer of finishing or dyeing, assistant superintendent, superintendent or manager.

Age 53, married; references.

A-C-D-1

Education—Chemistry, Temple College, Philadelphia, evenings. Dyeing and textile chemistry, Philadelphia Textile School.

Experience—Employed about 18 years in textile mill, becoming chemist; 5 years as superintendent of finishing on silk and rayon ribbons; 10 years as salesman of chemicals and textile specialties in eastern Pennsylvania and parts of New Jersey; has some knowledge of the processing of all textiles. Seeks position as salesman with well known company.

Age 48; married.

B-10

Education—2 years chemistry, 2 years textile chemistry and dyeing, Lowell Textile Institute, evenings.

Experience—4½ years dyeing and bleaching hosiery, specializing in children's and infants' hose; 3 years assistant dyer, dyeing and bleaching cotton, mercerized and unmercerized, wool, wool-cotton, wool-rayon and wool-silk hose. Seeks position as second hand, assistant dyer or laboratory assistant in hosiery mill.

Age 27; single; references.

B-D-1

Education—High school graduate; textile chemistry, Textile Evening High School, New York City; accounting; typist.

Experience—from 1935 to present employed as colorist with screen printing plant in New York City. Experienced with all types of fibers and all types of dyes. Shade matching. Versed in accounting, typing, modern office procedure and sales promotion. Able assistant to busy executive. Age 46; single; references.

C-1

Experience—Experienced as assistant finisher, finisher and superintendent of finishing since 1923. Experience on automobile cloth, boucle overcoatings, high grade men's wear worsted, low grade woolens, medium grade plaid-back overcoatings, fleece finish overcoatings, Bolivias, kerseys, medium-grade men's piece dye suitings, uniform cloth, flannels, ladies' dress goods and coatings, government serge and elastique fabrics, marine wool, flannel shirtings.

Age 37; married, 3 children; references.

Abstracts of Papers Presented Before

Division of Cellulose Chemistry

AMERICAN CHEMICAL SOCIETY

Buffalo, N. Y., September 10, 1942

E. E. HARRIS, *Chairman* C. R. FORDYCE, *Secretary*

THURSDAY MORNING AND AFTERNOON

9:30-1.—X-Ray Studies of Reactions of Cellulose in non-aqueous systems. II. Interaction of Cellulose and Primary Amines.

W. E. DAVIS, A. J. BARRY, F. C. PETERSON, AND A. J. KING.

X-ray study of the swelling of cellulose by amines has been extended to include the entire series of primary straight-chain amines from methylamine to heptylamine. Values of the 101 interplanar distance range from 14.67Å. for methylamine-cellulose to over 28 Å. for heptylamine-cellulose, while the 101 distance remains about the same throughout the series.

A mechanism has been proposed to account for the swelling, involving formation of hydrogen bridges between cellulosic hydroxyl groups and molecules of the amine. Failure of the higher amines to swell cellulose unless the latter has been pre-swollen with ammonia or one of the lower amines is ascribed to a steric effect. A similar effect accounts for the failure of such liquids as water, alcohols, and monoethanolamine, which are associated into large molecular aggregates, to swell cellulose.

10:00-2.—Carbamates of Cellulose and Cellulose Acetate. I. Preparation

W. M. HEARON, GORDON D. HIATT, AND CHARLES R. FORDYCE, EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

The preparation of aliphatic and aromatic carbamate esters of hydrolyzed cellulose acetates has been carried out. Aliphatic isocyanates have been found to react with some difficulty and in certain cases to produce gels. Aromatic isocyanates, however, react in pyridine quickly and completely with free hydroxyls of cellulose acetate to produce soluble, fibrous products. Various factors of time, temperature, cellulosic material, and amount of reagent have been studied.

Aromatic isocyanates also react in pyridine with low viscosity cotton linters to give a tricarbamate showing good solubilities. When less than sufficient reagent to cover all hydroxyls is used, complete reaction of the isocyanate takes place but the product is insoluble in solvents and remains unchanged in appearance.

10:30-3.—Carbamates of Cellulose and Cellulose Acetate. II. Stability Toward Hydrolysis

W. M. HEARON, GORDON D. HIATT, AND CHARLES R. FORDYCE, EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

Mixed esters of cellulose acetate and phenyl carbamate have been subjected to acid and alkaline hydrolysis. Acid hydrolysis in solution removes acetyl slowly with complete retention of all carbamate, however, the products are somewhat degraded. Alkaline suspension hydrolysis proceeds with easy removal of all acetyl and 6 to 8 per cent loss of carbamate and no appreciable degradation. More drastic alkaline conditions were unsuccessful in removing all carbamate from the cellulosic material.

The alkaline suspension deacetylation method has been used to prepare partially esterified cellulose phenyl and alpha-naphthyl carbamates. These esters are soluble in organic solvents, whereas partial reaction of hydroxyls of cotton linters with these isocyanates yields insoluble products.

11:00-4.—Hydrolysis and Catalytic Oxidation of Cellulosic Materials. V. Structure Analysis by Progressive Hydrolysis and Reconstitution

R. F. NICKERSON AND J. A. HABRLE, MELLON INSTITUTE, PITTSBURGH, PA.

Samples of cotton linters were hydrolyzed in boiling 2.5 normal hydrochloric acid or its equivalent for varying lengths of time up to 7 hours. The insoluble solids were recovered, purified, and investigated further. Quantitative measurements of the carbon dioxide output of the different dry preparations in boiling 2.5 normal hydrochloric acid-0.6 molar ferric chloride indicate that intact linters are structurally heterogeneous and that about 0.8 hour of hydrolysis under the conditions suffices to produce homogeneity. Moisture adsorption data show a sharp minimum after 3 to 4 minutes of such hydrolysis. The evidence suggests that the boiling acid removes the amorphous part of the fiber in 3 to 4 minutes and the mesomorphous in approximately 0.8 hour.

The hydrolytic behavior of intact linters can be simulated more or less perfectly with an artificial mixture of "4-minute hydrocellulose" and dextrose. It appears, therefore, that the amorphous fraction of linters—about 3.2 per cent—is easily hydrolyzed, true cellulose.

11:25-5.—Mechanism of the Oxidation of Cellulose.

G. GOLDFINGER, H. MARK, AND S. SIGGIA, BROOKLYN POLYTECHNIC INSTITUTE.

Cotton linters, both native and previously treated to obtain various degrees of internal surface, were submitted to the oxidizing action of periodic acid. The reactions yield oxycellulose in which a fraction of the glucose units are oxidized in carbon atoms 2 and 3 to aldehyde and carboxyl.

An analysis of the oxidation products submitted for various lengths of time to the oxidizing action of periodic acid shows an initial increase of the number of glucoses oxidized to "aldehyde cellulose" and a subsequent decrease of the number to less than can be experimentally detected. At the same time, the number of glucose oxidized to "carboxyl cellulose" shows a steady increase which continues after the concentration of the "aldehyde cellulose" becomes equal to zero. The results can be represented by two differential equations of the type:

$$\frac{d(CHO)}{dt} = k_2 [S - (CHO) - (COOH)] [\bar{10_4}] \quad (1)$$

$$\frac{d(COOH)}{dt} = k_3 [CHO] [\bar{10_4}] \quad (2)$$

(where S represents the surface area and the terms in parenthesis the number of glucose units oxidized as indicated and the concentration of the oxidizing agent).

The solubility of the oxidized cellulose in caustic soda shows a linear increase with increasing number of oxidized glucose units. The linearity is maintained beyond the point where 15 per cent of all glucoses are oxidized. About 40 per cent of the sample is soluble under these conditions in 17.5 per cent caustic soda solution at 20° C.

From the trend of the rate of oxidation on one hand, and the amazingly low solubility of the oxidized samples on the other hand, we can conclude that first the glucose on the internal surface of the cellulose will be oxidized, first to aldehyde and as the available unoxidized glucose decreases in concentration the aldehyde is oxidized to carboxyl. Further penetration of the oxidizing agent and oxidation of glucoses in the interior of cellulose will be detectable only after completion of the oxidation at the readily available surface. Consequently the solubility measurements indicate depth of oxidation rather than the alkali resistance and solubility of cellulose as a function of its degree of polymerization.

2:30-6.—Analysis of Cellulose Derivatives. III. Determination of Free Hydroxyl Content

CARL J. MALM, LEO B. GENUNG, AND ROBERT F. WILLIAMS, JR.,
EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

A method for the determination of free or unsubstituted hydroxyl groups in cellulose derivatives has been developed, which makes use of the acetic anhydride in pyridine reagent of Verley and Bölsing. Acetylation at 75° to 80° C. for about 24 hours using half-molar reagent in generous excess gave results on the samples of cellulose acetate, acetate propionate, and acetate butyrate tested, which agreed well with hydroxyl values calculated by difference from the acyl analyses. The effects of time, temperature, anhydride concentration, and excess were studied and optimum ranges for each were established.

Equations and graphs are presented with which per cent hydroxyl can be converted to hydroxyls per glucose unit of cellulose.

The method is useful for checking the accuracy of other analytical procedures, analyzing multicomponent derivatives whereby one component is calculated by difference, and for correlating free hydroxyl with certain useful physical properties. Most commercial cellulose esters have essentially three replaceable hydroxyl groups per glucose unit of cellulose and this assumption is used in many calculations. Certain very low viscosity samples, however, contain more than three hydroxyls and the deviation from three may be used for the calculation of an average degree of polymerization of such samples.

3:00-7.—Analysis of Cellulose Derivatives. IV. Determination of Small Amounts of Combined Sulfur.

CARL J. MALM AND LEO J. TANGHE,
EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

A method has been developed for the determination of very small amounts of sulfur in cellulose derivatives, based on oxidation with nitric acid and fusion with potassium nitrate.

Samples of cellulose acetate have been prepared containing both large amounts of salt sulfates and combined sulfate and the application of dilute hydrochloric acid rinses to these esters showed that salt sulfate is readily washed out, while combined sulfate is retained. It is thus possible to differentiate between combined and noncombined sulfate, since two short rinses of the finely ground cellulose acetate with 0.1 per cent hydrochloric acid have been found sufficient to remove the latter.

Hydrochloric acid rinses of a distilled water processed cellulose acetate reduced the sulfur content only when the sample was dried before acid rinsing, indicating that some of the combined sulfate was split off during the drying.

3:20-8.—Report of Committee on Standards and Methods of Testing

3:40-9.—The Ultraviolet Absorption Spectra of Compounds Related to Lignin

R. F. PATTERSON AND HAROLD HIBBERT,
DIVISION OF INDUSTRIAL AND CELLULOSE CHEMISTRY, MCGILL UNIVERSITY.

The absorption spectra of a number of aromatic compounds have been determined and certain relationships between structure and absorption noted. Among the materials investigated were the derivatives of vanillin and syringaldehyde recently isolated from wood by Hibbert and co-workers and thought by them to be lignin progenitors or degradation products.

From the absorption curves of these substances and others closely related to them the following conclusions have been drawn: (1) Compounds containing the vanilloyl or veratroyl groups have three absorption bands in the ultraviolet region at approximately 980f, 1070f, and 1300f. (2) Substances in which the syringoyl or 3,4,5-trimethoxybenzoyl groups are present lack the band at 1070f. (3) The 980f band is due to the presence of the carbonyl group in conjugation with the benzene ring. A similar effect may be produced by a conjugated ethylenic double bond. (4) The existence of the 1070f band is due to freedom of the position meta to the point of attachment of the side chain. (5) It is suggested that the 1300f band is a characteristic of the aromatic carbon-carbon linkage.

4:00-10.—The Ultraviolet Absorption Spectra of Ethanol Lignins

R. F. PATTERSON AND HAROLD HIBBERT.
DIVISION OF INDUSTRIAL AND CELLULOSE CHEMISTRY, MCGILL UNIVERSITY.

The ultraviolet absorption spectra of various lignins obtained from spruce and maple woods by the action of ethanolic hydrogen chloride are reported. These are compared with the curves of the known compounds discussed in the previous paper and it is concluded that (1) the spectra of amorphous lignins can be explained satisfactorily on the assumption that these materials are derived from lignin precursors of the types exemplified by hydroxypropiovanillones and hydroxypropiosyringones; (2) the absorption curves indicate the essentially aromatic character of lignin; and (3) a carbonyl group or an ethylenic double bond is present in conjugation with the the aromatic nucleus to some at present unknown extent.

4:15-11.—Studies on Lignin and Related Compounds. LXIV. Isolation and Identification of (4-Hydroxy-3, 5-Dimethoxyphenyl)-Propanone-2 and (4-Hydroxy-3-Methoxyphenyl)-Propanone-2 From Maple Wood

MARSHALL KULKA AND HAROLD HIBBERT,
DIVISION OF INDUSTRIAL AND CELLULOSE CHEMISTRY, MCGILL UNIVERSITY.

Two new carbonyl constituents of the ethanolysis oils of maple wood, namely, (4-hydroxy-3,5-dimethoxyphenyl)-propanone-2 (I) and (4-hydroxy-3-methoxyphenyl)-propanone-2 (II), have been isolated and identified by direct syntheses. The isolation consisted of treatment of the bisulfite-soluble fraction of maple wood with hydroxylamine sulfate and nickel chloride [Kulka, Hawkins and Hibbert, J. Am. Chem. Soc., *63*, 2371 (1941)]; under these conditions the dicarbonyl constituents precipitated as their nickel glyoxime salts, the aldehydes, vanillin and syringaldehyde remained unchanged, and (I) and (II) formed oximes. The aldehydes were separated from the oximes of the new carbonyl compounds, (I) and (II) by extraction with sodium bisulfite. (I) and (II) were separated by fractional distillation.

(I) was synthesized by the condensation of syringaldehyde with nitroethane, reduction of the resulting nitroalkene to the corresponding oxime, and hydrolysis of the oxime. The guaiacyl analog was synthesized similarly starting with vanillin instead of syringaldehyde.

(I), (II) and the other ethanolysis products (Kulka, Hawkins and Hibbert; above reference) isolated from higher plants (angiosperms and gymnospherms) show a remarkable parallelism with certain aromatic metabolic products of lower plants (molds) in regard to side chain structure. [Oxford and Raistrick, Biochem. J., *27*, 634 (1933)]. This similarity in type seems to provide support for Hibbert's view of lignin as a mixture of products arising from a group of monomecular compounds of C_6-C-C-C type whose primary function is that of respiratory catalysts.

ACID DYEING AND ANIMALIZING

(Continued from page 494)

fiber not to mention the search for the most suitable method of application.

The use of casein in this respect is interesting but before proceeding to the discussion of some of the methods available for its application in this sphere it may be worth noting a few facts regarding the use of casein itself in the production of fibers with wool-dyeing properties. The commercial fiber consists of practically pure casein, the raw material for which is skim milk. The fiber is manufactured in a somewhat similar manner to viscose and the main points in the process relate to the hardening of the fiber by the use of formaldehyde, alumina or certain synthetic "tanning" or toughening agents used for a similar purpose. Without this hardening process the fiber would be useless as casein would disintegrate in hot liquors such as dyebaths, etc. Lanital is the chief representative of this class and dyeing may be carried out in a manner similar to wool dyeing. The fiber has affinity for direct and acid dyes and lends itself readily to mixtures with viscose staple fiber and with wool. It is susceptible to high temperatures and is easily damaged by abrasion, etc. Solid shades are easily obtained with substantive dyes on viscose but solid effects on wool are hard to bring about in consequence of the effect of high temperatures on the casein fiber.

In view of the foregoing facts it can be seen that incorporation of casein in suitable forms into other fibers, e.g., viscose rayon would impart affinity for acid dyes. So far as casein and its products are concerned, it would seem that incorporation with the viscose spinning solution is the method most suited to the case. The process is covered by a number of patents. E. P. 438,199 and 440,449 cover the incorporation of casein into viscose spinning solutions. E. P. 472,964 covers a method whereby the bleeding of acid dyes in the dyeing of mixed wool and viscose is remedied by suitable additions to the foregoing. E. P. 501,653, 505,976 and 509,852 cover the addition to the spinning solutions of products of the reaction between casein and other proteins, and ethylene imine and aromatic isocyanates. This type of fiber is represented by Cisalfa (Italian) 4½ per cent casein, and Fibramine (Belgian) with a similar amount of protein. These are what might be termed true "animalized" fibers to distinguish them from those known as "basified" in consequence of the latter type having incorporated in their structure synthetic resins with basic groups thus imparting the necessary affinity for acid dyes.

On this problem of basifying, a large amount of intensive research has been carried out and a brief outline of the trend of this work will be attempted in the following notes. Wakelin in *Textile Colorist* 1938, 60, 227-330 mentions (a) the use of p-toluene sulfonyl chloride and ammonia for treating rayon staple fiber; (b) casein as addition to viscose rayon spinning solutions, a process covered by E. P. 438,199; 440,449; (c) an ingenious method for use on cotton based on the reactions of the group of proteins which includes *globulins* (in this case nut-seed globulin) with inorganic salts, urea and formaldehyde. The globulins are soluble in dilute salt solutions, in this instance urea, from which they may be precipitated by saturation of the original solution with an inorganic salt e.g. ammonium sulfate. This type of treatment is followed by a further process involving the use of formaldehyde covered by patents: (d) products derived from ethylene diamine are dissolved and used for treating the cotton, an example is N-stearyl-N′-N′-diethyl-ethylene diamine mono-hydrochloride. (e) B. P. 462,290 deals with the use of complex aromatic compounds such as those derived from benzidine containing quaternary ammonium groups. (f) The use of ethylene imine vapor for pretreatment of viscose prior to desulfuring, covered by E. P. 476,431.

Other applications with a similar end in view are as indicated briefly in the following notes on the various patents. B. P. 471,880 deals with the impregnation of cotton yarn or rayon material with aqueous solutions of products obtained by reaction of amines on suitable alkylating agents, and subsequent baking for polymerization and formation of the synthetic resin. In B. P. 501,913 cellulosic materials with reactive OH groups are treated with bodies, e.g., aliphatic isocyanates with subsequent baking or heating to form the polymer. In B. P. 504,572, cellulosic rayons in the form of fiber, yarn or fabric are treated with dilute aqueous liquors containing a suitable proportion of a product obtained by reaction of a primary aromatic amine with formaldehyde in the presence of acid. Treatment is by immersion, rinsing and drying. Suggestions are p-chloraniline hydrochloride, p-toluidine sulfate, anisidine and p-brom-aniline along with formaldehyde. B. P. 506,793 deals with the treatment of cellulose by immersion in a liquor containing cyanimide and formaldehyde, condensation being induced by an acid or neutral medium. The material in the form of staple fiber is immersed, hydroextracted, dried and baked at 140 deg. C. B. P. 510,516 gives a method for the treatment of cellulosic fibers with solutions of precondensates of urea formaldehyde or thiourea formaldehyde mixed with such compounds as cyanamide, biguanide or guanidine in the absence of formaldehyde and in the presence of an acid catalyst, followed by heating to 150 deg. C. and subsequent dyeing. If desired, the solution may be added to the spinning

solution. B. P. 532,113 deals with the incorporation in an aliphatic carboxylic ester of cellulose of a free aliphatic diamine containing fewer than 7 carbon atoms. The amalgamation may take place by the addition of the diamine to the cellulose ester solution prior to spinning or by the saturation of the thread after spinning. Again, an insoluble condensate may be formed by treatment of the yarn, etc., containing the diamine prior to dyeing, with formaldehyde, carbon disulfide, etc. In B. P. 532,215 is given details of a method whereby cellulose is esterified by halogenated organic acids and organic acid anhydrides, the product being a mixed halogenated ester of cellulose with another ester radical; followed by treatment with an organic base, e.g., pyridine. If desired the products of the mixed ester in the form of filaments, foils, etc., may be treated after their formation, with pyridine instead of prior to the formation of the product as previously indicated. B. P. 535,888 deals with the purpose of basifying textile materials or increasing the basic character of such materials for the impartation of increased fastness to washing. The treatment may be applied to animal, vegetable or regenerated cellulosic material. B. P. 536,686 is based on the affinity of acid wool dyes for condensation products resulting from reaction between an aryl isocyanate or isothiocyanate with a polyalkylene polyamine, applied to viscose staple fiber by impregnation from aqueous suspension or by addition to viscose spinning solution, preferably the latter. These products may be halogenated to increase their affinity for acid dyes and so prevent bleeding which is apt to occur otherwise. Condensation products may be chlorinated prior to addition to viscose spinning solution if desired. Chlorination can also take place during the removal of yellowing by hypochlorite during the process of desulfurizing.

To wind up this section of the remarks on the subject it may be worth noting a few other points of interest. An earlier method than any which have been quoted for bringing about affinity for acid dyes is described in B. P. 353,930. A cellulose xanthate derivative obtained by mild oxidation of the xanthate or by reaction with such bodies as sulfur chloride, phosgene, acetyl chloride, etc., is treated with an aliphatic diamine, e.g., ethylene diamine, piperazine, etc. A printed effect capable of absorption of acid dyes may be produced by printing-on caustic soda, xanthating with carbon disulfide and then treating as described. According to B. P. 496,944, the fastness of dyeings produced on cellulosic materials which have been treated to give them affinity for acid dyes by methods other than those employing alkylating agents in the form of inorganic or inorganic-organic acid esters or reactive substitution products thereof, is increased particularly to washing treatments, by amalgamation with the cellulosic matter prior to, during or subsequent to the basifying treatment, of a non-basic mordant for basic colors which is itself practically colorless. If desired both processes may be carried out simultaneously by incorporation of the required reagents to the spinning solutions prior to spinning. Indications for the first step, i.e., imparting affinity for acid dyes, are the use of the polyalkylenepolyamines, urea and guanidine derivatives. Mordants are tannin, gall-nut extract, phenol-sulfur products, etc., etc.

Further light on the subject is supplied by Eckert, Herr and Fischer, who have made a study of the main factors affecting the adsorption of acid dyestuffs by fabrics treated in this manner. The results are published in *Klepzig's Textil-Z*, 1938, 41, 624-627, 634,637, 646-647; 1939, 42, 164-168. The main conclusions are that acid dyestuffs on this type of fiber show generally similar behavior to that on wool in respect to pH value, i.e., the affinity of the dyestuff increases with decreasing pH. In both cases the rate of adsorption decreases with increasing pH. In the case of animalized fibers the increase of dyebath volume slows up the rate of dye adsorption. A similar effect is produced by an increasing number of sulfo groups in the dyestuff molecule, in addition to which the dyeing power is also reduced.

The discussion of this subject would hardly be complete without some reference to the newer types of fiber e.g., nylon, Vinyon, etc. Lanital has already had some attention in these notes, so some brief remarks on the other types may not be out of place. Nylon is a generic name, i.e., it gives its name to a group or species the members of which are, in the words of Chambers's Dictionary, "closely connected by common characters or natural affinity." Nylon fibers have a protein-like basis and are the products of long-chain di-amino-di-carboxylic compounds with amino and carboxylic groups at the ends of the chains capable of extended condensation to form super polyamide resins. It was Fischer who first showed the possibility of the production of such substances by the condensation of long-chain compounds of this type to form linear polymers. Glycine NH_2-CH_2-COOH which is found in the fibroin of silkworms to the extent of about 40% is a typical forerunner of such bodies. In the case of nylon types, condensation can be carried to great lengths but there are limits at which closed rings of carbon compounds are formed instead of the long-chain linear products. Inside these limits the length of the chains may be controlled in such a way that characteristic differences of any desired type (within limits) are imparted to the material from which the ultimate fibers are to be spun.

One of the principal features of the manufacture of this type of fiber is the "drawing" or elongating process during or after spinning whereby such alignment of the molecular linear condensate is brought about that a remarkable increase of strength is obtained. The process may be described briefly thus:—the molten material from which the fiber is spun is extruded say at 200 deg. C. through coarse spinnerettes to form thick fibers about 30 times the diameter of a viscose fiber, of such plasticity that they can

be further drawn in the cold state after pretwisting, to form much finer fibers. Cold drawing, which may elongate the fibers anywhere from four to seven times their original length imparts strength, elasticity and luster to the fibers besides modifying considerably their other properties, e.g., power of absorption of moisture, dyeing qualities, etc. The coarse fibers as originally spun prior to drawing have ductility but not elasticity, etc.

The affinity of such fibers for dyestuffs is still the subject of much investigation but generally speaking such protein-like bodies being more akin to natural fibers, e.g., silk and wool, have somewhat similar dyeing properties. Substantive dyes, vats and sulfurs do not show much affinity for either nylon or the animal fibers, except in special cases. The derivatives of anthraquinone used in the dyeing of cellulose acetate show considerable dyeing power in relation to both classes, being substantive to nylon, silk and wool. While the acid wool dyes generally have affinity for nylon, it is considered that they are not completely satisfactory in consequence of the difficulty of producing deep shades. Penetration is difficult to obtain and rubbing or crocking of the deeper tones is pronounced.

It is fairly evident that the properties of fibers produced in this manner are liable to variation as the result of variation which may take place in the course of manufacture. B. P. 495,790 deals with one aspect of this problem, i.e., the stabilization of the viscosity of the molten polymer prior to spinning. The original difficulty arose from the additional polymerization which took place during spinning at high temperatures above the melting points of the polymers. The stabilization acts as a check to this undesirable extension of polymerization which made the process more difficult to control and altered the characteristics of the spun material. It is interesting to note that stabilized nylon fibers of this type have increased affinity for dyestuffs as evidenced by the following particulars: affinity for basic dyes is increased by incorporation of free acid terminal groups into the molecule to bring about stabilization. Improved dyeing qualities towards direct dyes is imparted to stabilized superpolyamides which contain basic groups. Again stabilization with hexamethylene diammonium acetate imparts increased affinity for substantive and acid dyes.

Vinyon is a long-chain thermoplastic polyvinyl resin having the linear molecular structure which makes it suitable for spinning into fibers in the manner described for nylon. It is in reality a co-polymer of vinyl chloride and vinyl acetate. The vinyl chloride polymer has great strength and inherent tenacity but is not suitable for the spinning of textile fibers. On the other hand vinyl acetate polymer while not nearly so strong as the chloride polymer has special properties which by co-polymerization to form a vinyl chloro-acetate compound imparts new possibilities and textile qualities to the co-polymer. So far as dyeing qualities are concerned these are modified by the properties of the fibers. Many modified standard procedures are now available and the whole subject is under constant consideration.

Rayolanda of Courtauld's Ltd. may be termed a basified type of viscose but it would appear that the viscose undergoes some constitutional alteration during the process of incorporating suitable synthetic resins. Such fibers resemble rayon rather than wool. Rayolanda in particular has remarkable affinity for acid wool dyes and is eminently suited for blending and spinning with wool. The fiber also exhibits good affinity for chromes, basics, sulfurs, substantive dyesuffs and the soluble leuco esters of vat dyestuffs.

NEW BLACKOUT PAINTS

ANNOUNCEMENT was made recently of the successful development, after lengthy experimentation, of new blackout paints that will shield dyehouses and kindred chemical establishments from infra-red photography by night and that are impervious to chemicals in the air.

Because these newest blackout paints are impervious to infra-red photography, dyehouses to which they are applied cannot be photographed at night from the air by reconnaissance planes that might not dare to fly over in the daylight. All up-to-pace reconnaissance planes are now equipped with aerial cameras fitted with infra-red filters for photography in the dark.

To prevent the reflection of moonlight from glass surfaces and to prevent inquisitive persons inside dyehouses from scratching away at the paint for a peek outside during blackouts, these latest blackout paints are applied to the exteriors of doors and windows, as well as to headlights and bright lights of all kinds.

Before applying the paints, all surfaces should be washed with ammonia water or gasoline to remove all grease; and, to insure complete blackout protection at all times, the paints should be reapplied about every six months.

To cope with varying climates and weather conditions, and, more specifically, to meet successfully with the special atmospheric conditions that are peculiar to various special sections of the country, many different paints have been developed.

Thus, in such chemical and electro-chemical centers as Buffalo and Niagara Falls, the paints have to be constituted so that chemicals always present in the air will not eat through them.

Special blackout paints have also been devised for use on doors, windows and headlights of autos and ambulances, police and fire apparatus, buses and trucks, street cars and railroad trains, as well as for use in the home and at the office, in mill and factory, store and shop, school and hospital, public works and public buildings, churches and institutions of all types, hotels and restaurants, theaters and clubs, in fact, for virtually every place where complete blackout protection is desired.

• CELANESE PATENTS

Celanese Corporation of America recently was granted two United States Letters Patents.

According to Patent Number 2,296,329, yarns consisting of a mixture of wool fibers and artificial staple cellulosic fibers are wetted and the wet yarn stretched about 15 to 25 per cent. The stretched yarn is then dried under conditions that permit shrinkage of the yarn to within 1 to 5 per cent of its original length and release of the strains set up in the stretching operation.

This process yields yarns of an elastic and voluminous character.

According to Patent Number 2,296,379, plasticized fabric containing yarns or fibers of cellulose acetate is first softened. The thus softened fabric is then dyed under such conditions that it is crushed, for example, by winch-dyeing.

By this process, novel and highly desirable mottled and marbled effects may be readily obtained.

• WPB FIELD OFFICES

The War Production Board have again urged businessmen that whenever they wish to obtain information from WPB they should go to their regional or field offices before coming to Washington.

"We have 12 regional and 127 field offices scattered throughout the country," the announcement said. "They were established in order to save businessmen the trouble of coming to Washington, and also to prevent an overload of work in Washington.

"When a businessman comes to Washington instead of going to his regional or field office he not only undergoes considerable expense and inconvenience himself, but also increases the burden on the men in Washington. Furthermore, the businessman can usually get quicker action in the field."

• MEETING ON LATIN AMERICAN TEXTILES

A meeting of interest and importance to textile men is to be held at the Hotel Roosevelt, New York, N. Y., November 5, 1942 at 8:00 P.M. The subject of the meeting is, the cotton textile industry in Latin America. Albert L. Scott, President of Lockwood Greene Engineers, Inc. is to give a survey of the entire cotton textile industry in Latin America covering raw materials, labor, technical progress, problems of financing and related matters. Mr. Scott plans to give special attention to the growing cotton industry of Brazil. Cuba and Mexico will also be included in this survey. Any members of the cotton textile industry who are interested in this subject will be welcome and any further information in regard to the meeting can be had from the Research Office of the Latin American Economic Institute, 429 West 117th Street, New York, N. Y. Tel. Monument 2-2981.

• U. S. GOVERNMENT MANUAL

The Fall edition of the United States Government Manual, a 700-page reference book on the creation and organization functions and activities of the Federal Departments and Agencies, was published September 29th.

The new edition which contains changes through September 1, includes statements on all the branches of Government, a list of principal officials, separate sections on the emergency war agencies, organization charts, publications and commonly used abbreviations.

It also contains an appendix on agencies abolished, transferred or consolidated since 1933.

The Manual may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., or at the U. S. Information Center, 1400 Pennsylvania Avenue N. W. Single copies cost $1; subscriptions covering the three editions a year cost $2.75.

• OFFICE OF TECHNICAL DEVELOPMENT

Appointment of a committee of engineers and scientists to determine the manner in which the projected Office of Technical Development should be set up within the War Production Board, and to define the scope, functions and method of operations which the Office should have, was announced recently by Chairman Donald M. Nelson.

Decision to establish such an Office was made earlier, following a report by a previous committee recommending that the War Production Board set up a strong scientific and technical organization to make sure that the nation's technical ability and resources were utilized to the full in the war production program.

Chairman of the new committee is Webster N. Jones, Director of the College of Engineering, Carnegie Institute of Technology at Pittsburgh. Other members are:

Dr. Lawrence W. Bass, Director of Research, New England Industrial Research Foundation, Boston.

Dr. Oliver E. Buckley, President, Bell Telephone Laboratories, New York.

Col. Clarence E. Davies, Ordnance Department, U. S. Army, Washington.

Dr. Ray P. Dinsmore, Manager, Development Department, The Goodyear Tire & Rubber Co., Akron, Ohio.

Admiral J. A. Furer, U. S. Navy, Washington.

Dr. Jerome C. Hunsaker, head of the Departments of Mechanical and Aeronautical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

H. W. Graham, Director of Metallurgy and Research, Jones and Laughlin Steel Corp., Pittsburgh.

S. D. Kirkpatrick, Editor of *Chemical and Metallurgical Engineering*, New York.

• DORMANT SCRAP DRIVE

A nation-wide industrial "dormant scrap drive," starting on October 1st was organized by the Conservation Division of the War Production Board, it was announced recently by Lessing J. Rosenwald, Director.

Seventy thousand industrial executives will be contacted by the Industrial Salvage Section of the Conservation Division. They will be asked to make an inventory of all dormant scrap materials and to make a complete disposal of all these materials through regularly organized scrap dealer channels as rapidly as possible.

Dormant scrap is defined as obsolete machinery, tools, equipment, dies, jigs, fixtures, which are incapable of current or future use in the war production effort because they are broken, worn-out, irreparable, dismantled or in need of unavailable parts necessary to practical re-employment. Dormant scrap should not be construed to apply to reusable machinery, equipment, dies, jigs, or fixtures, which can currently or in the future be used by the owner or others, with or without repairs, in work which contributes directly to the war production effort.

The field force of the Industrial Salvage Section has been doubled and now comprises 140 men. However, in order to complete successfully this "dormant scrap drive," the regular field staff has been supplemented by 2,500 volunteer salesmen and sales executives, who have been certified to serve as temporary field men of the Industrial Salvage Section during this special drive.

These salesmen have been drawn from the sales staffs of all the major steel companies, the American Steel Warehouse Association and the Associated Equipment Distributors. Through the active participation of sales executive organizations in most of the larger cities, hundreds of sales executives and salesmen will be coordinated into service in all WPB areas to aid in this program. Operation of this program has been organized by the Industrial Salvage Section, under Hamilton W. Wright through the regional chiefs of the WPB, and the American Industries Salvage Com-

mittee, which is headed by Robert W. Wolcott.

Executives of these organizations, heading up the salvage program in conjunction with this special dormant scrap drive, are: George Ross, Secretary of the Salvage Committee of the American Iron and Steel Institute; Walter S. Doxey, President, American Steel Warehouse Association; C. F. Winchester, Executive Secretary, Associated Equipment Distributors, and H. R. Doughty, Director of Field Operations on Salvage for the National Federation of Sales Executives.

Continuous production from open-hearth and electric furnaces and other users of scrap during the winter months of 1943 is dependent on the collection of seven million additional tons of iron and steel scrap prepared for delivery to the mills for use during the winter months.

Accordingly, top executives of all industrial plants are being urged to:

1. Instruct the salvage executive of their plant, together with other necessary executive officials, to inspect all areas of their plant to determine what salvageable items falling in the above scrap classification can be scrapped.
2. Mark clearly each such item for quick identification and make a list in duplicate, for their own use, in order that plant management may authorize the disposition of each item. Indicate approximate weight opposite every piece of dormant scrap.
3. Arrange immediately to dispose of all dormant scrap.

The Government's grave responsibility to supply American armed forces with ships, guns, airplanes and tanks, necessitates the adoption of this scrap program. The suggested policy by the Industrial Salvage Section to Industry with regard to the spotting and disposal of dormant scrap is as follows: "If it hasn't been used for the last three months, and no one can prove it can be used in the next three—find a use for it or scrap it."

• REORGANIZATION, TEXTILE DIVISION

Reorganization of the textiles, leather and apparel division of the Office of Price Administration was announced recently by Bernard F. Haley, who recently assumed the position of acting director of the division.

In place of the three previous sections which dealt separately with textiles, leather and apparel and the numerous units under these sections, the new setup calls for eight specialized price sections.

In naming the personnel, all of whom were members of the previous textiles, leather and apparel sections, Mr. Haley said that the appointments as well as the internal organizational structure in the newly created division are tentative.

Charles A. Marquardt, formerly Administrative Officer of the branch, will serve as assistant to Mr. Haley on textiles and leather matters. An assistant to the director specializing on apparel problems is to be named.

The eight new price sections and their acting heads are as follows:

Cotton section, John F. Van Ness, with Hilding Anderson acting head of a cotton ginning unit in this section;

Wool section, Russell Burrus;

Rayon section, J. Holmes Daly, with Frederick Niederhauser acting head of a synthetic yarns unit;

Leather section, John H. Patterson;

Men's apparel section, Theodore Rothschild, with E. Glenn Elliott acting head of a work clothing unit;

Women's apparel section, Sidney Shreero;

Knitwear and hosiery section, George Urlaub;

Shoe section, Edgar Rand.

An economic analysis branch has been set up to replace the three separate economic research units which had served the three previous sections. In this branch will be sections dealing with adjustments and amendment, review and research, war procurement liaison and standardization.

At the same time, Mr. Haley announced that Dr. John F. Bell, former associate price executive of the textiles section, was called by the University of Illinois to resume his post in the Department of Economics.

Sherman Trowbridge, acting associate price executive of the apparel section, has been commissioned a major in the Army of the United States and has been ordered to duty.

• PERKIN MEDAL AWARD

Dr. Robert E. Wilson has been selected to receive the Perkin Medal of the Society of Chemical Industry for 1943. This medal is awarded annually for outstanding work in applied chemistry and the medalist is selected by a Committee representing the five chemical societies in the United States.

Dr. Wilson was born in Beaver Falls, Pennsylvania, and graduated from The College of Wooster, Ohio, in 1914. He then took two years of advanced work in chemical engineering at the Massachusetts Institute of Technology. He entered the government service at the outbreak of the first World War, advancing in rank to Major in the Chemical Warfare Service in charge of research laboratories working on gas mask absorbents and related problems.

In 1919 Dr. Wilson was called back to Massachusetts Institute of Technology as Director of the Research Laboratory of Applied Chemistry and was later made Associate Professor of Chemical Engineering. In 1922 he became Assistant Director of Research of the Standard Oil Company of Indiana, and in 1929, he was placed in charge of the newly formed Development and Patent Department of that Company. In 1931 he became a Director and in 1933 a Vice-President of the Standard Oil Company of Indiana.

In January 1935 Dr. Wilson became Vice Chairman of the Pan American Petroleum & Transport Company. Since February 1937 he has been President of the Pan American Petroleum & Transport Company, The American Oil Company, and other subsidiaries.

From June 1940 to August 1941 he served as Chief Petroleum Consultant to the Advisory Commission of the Council of National Defense, and its successor, the Office of Production Management. Since then he has been a member of the Petroleum Industry War Council and Chairman of the Council's Committee on Petroleum Economics.

In March 1942, at the request of the United States Treasury Department, he became one of four Managing Directors of the General Aniline and Film Corporation recently taken over from German ownership.

The medal will be presented on January 8, 1943 at a meeting to be held at The Chemists' Club, 52 East 41st Street, New York City. Details will be announced later.

• S.C.I. MEETINGS

The American Section of the Society of Chemical Industry has planned the following schedule of meetings for 1942-1943.

1942	
October 9	Joint meeting with the American Chemical Society, New York Section.
November 6	Chemical Industry Medal Award to Dr. Harrison E. Howe, Editor of *Industrial & Engineering Chemistry*. Joint meeting with the American Chemical Society. Details of meeting to be announced.
December 4	Details of meeting to be announced.
1943	
January 8	Perkin Medal Award to Dr. Robert E. Wilson, President of Pan American Petroleum & Transport Company. Joint meeting with the American Chemical Society, American Institute of Chemical Engineers, The Electrochemical Society and the Societe de Chimie Industrielle. Details of meeting to be announced.
February 19	Details of meeting to be announced.
March 5	Joint meeting with American Chemical Society. Presentation of William H. Nichols Medal by American Chemical Society.

• CATALOG, TECHNICAL BOOKS

The new 1942-43 catalog of technical books (64 Pages) of the Chemical Publishing Co., Inc., 234 King Street, Brooklyn, New York has recently been issued.

The new format was especially designed to enhance its utility and efficiency. Sections have been subdivided so that needed books or books on similar subjects can be found in a minimum time.

Every important field has been covered—Aviation, Engineering, Radio, Electricity, Mechanics, Chemistry, Formulas, Military and Naval Sciences and Dictionaries (Spanish, Russian, French, German), etc.

Included in the catalog are the Spanish and Portuguese books of Editorial Tecnica Unida, the Spanish subsidiary of the Chemical Publishing Co., Inc.

A copy will be sent to anyone upon request.

• PURCHASING OFFICERS NEEDED

The enormous expansion programs of Government establishments vitally connected with the war effort have vastly increased the volume and importance of the work of the Government Purchasing Officers. In order that Government establishments may operate at maximum capacity, it is imperative that Purchasing Officers be recruited who are skillful, resourceful, and far-seeing.

Purchasing Officers are now being sought for positions which pay from $2,000 to $4,600 a year. They will prepare specifications for the purchase of government supplies; prepare invitations to bid; and maintain current information with respect to market trends, fluctuations, sources of supply, and laws and regulations pertaining to Federal procurement.

The civil service examination announced for filling these positions calls for persons who have had from two to six years of responsible experience as purchasing or procurement officer handling large lots of materials of considerable variety. This experience may have been acquired with a large railroad, or other public utility, a large industrial or commercial establishment, a branch of the Federal Government or with the government of a State or large municipality.

Applications are not sought from persons engaged in war work unless a change of position would result in utilization of higher skills possessed by the applicant. In keeping with War Manpower Commission policy, individuals engaged in any production and maintenance occupations in non-ferrous metal mining, milling, smelting and refining, and logging and lumbering industries in the critical labor area which includes the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Orgeon, Texas, Utah, Washington, and Wyoming, cannot be considered for appointment in the Federal Government unless a certificate of separation from the United States Employment Service has been obtained by the Civil Service Commission.

There are no age limits for this examination. No written tests are required. Applications will be accepted until the needs of the service have been met. Announcements and application forms may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D. C.

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(Concluded from page 493)

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• CLASSIFIED • ADVERTISEMENTS

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $6.25 per column inch or less per insertion.

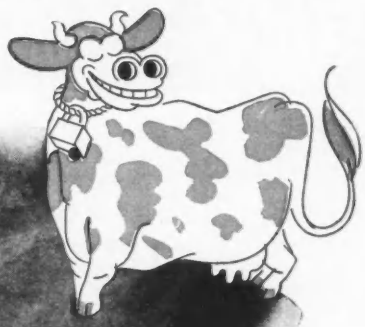
POSITION WANTED: *Hosiery Dyer and Chemist.* 25 years' experience on all types hosiery, dyeing and finishing, testing dyes and chemicals. Cost finding and purchasing. Phila. section preferred. Write Box No. 406, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: *Jig Dyer*—experienced in dyeing rayon, cotton and acetates. Must be capable of matching accurately. Man with technical background preferred. State salary desired. Write Box No. 407, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: *Chemist*—for technical development work in large rayon dyehouse. Must possess initiative. State qualifications, experience and salary desired. Write Box No. 408, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

HOW TO DYE ARALAC

the new textile fiber that comes from Cow's Milk



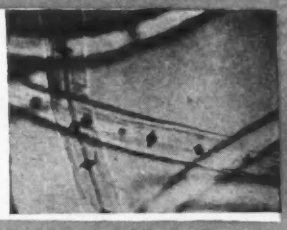
ARALAC, the recently developed protein fiber made from casein, is now being eyed with new interest by the textile industry.

Already ARALAC is being employed widely and satisfactorily in mixtures with wool, cotton, rayon, acetate, nylon, fur, in the manufacture of materials for coatings, suitings, dresses, neckties, scarfs, socks, interlinings, blankets, hats. And many other uses are in sight.

For some years now, CALCO technicians have been studying the application of dyestuff to this protein fiber, have been working to devise methods that bring about best results in dyeing and finishing operations.

Based on this extensive research, CALCO has prepared for your guidance and help a comprehensive and authoritative booklet, "The Processing of ARALAC And Other Protein Fibers." This valuable addition to your up-to-the-minute textile library will be sent you with our compliments, upon request.

Simple Microscopic Test Shows Presence of **ARALAC**



A simple and accurate microscopic test will aid you greatly in determining the presence of ARALAC. This test depends for its success upon the formation of diamond shaped stress figures (see illustration above) which incidentally somewhat resemble the shape of the CALCO trademark. These are formed when 50% sulphuric acid is allowed to flow around the fibers on a glass slide with a cover glass. The diamonds generally appear irregularly for a short time along the fibers, then change form and disappear as the fibers become soft.

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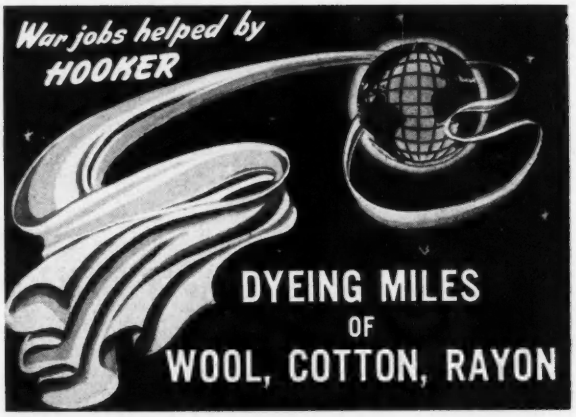

Never before have such quantities of textiles been dyed as rapidly and as well as in today's job of supplying our all-important armed forces. Never before has

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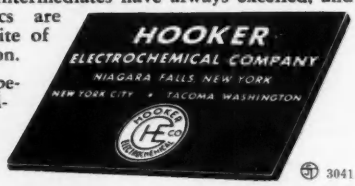
shouldered a greater responsibility to the producers of dyes and textile treating materials, for more than ever there is need for known quality standards and rigid adherence to them. In these respects HOOKER dye intermediates have always excelled, and the same characteristics are maintained today in spite of unprecedented production.

HOOKER technical specialists are always available for consultation on chemical problems within their fields.



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EXACT WEIGHT Scale Model 8003 DH (Dyehouse Special) . . . Furnished in white or blue baked enamel, metal parts corrosion treated to withstand chemical reaction. Sensitive to ⅛ oz. over and underweight—Capacity to 12 lbs.

THE EXACT WEIGHT SCALE CO.
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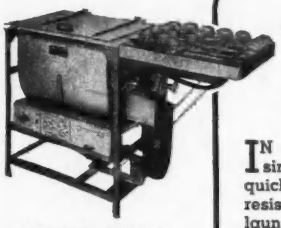

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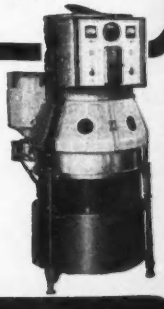
WEATHER-OMETER—Duplicates effect of actual exposure—months of sun, rain, heat and cold condensed to a few days.



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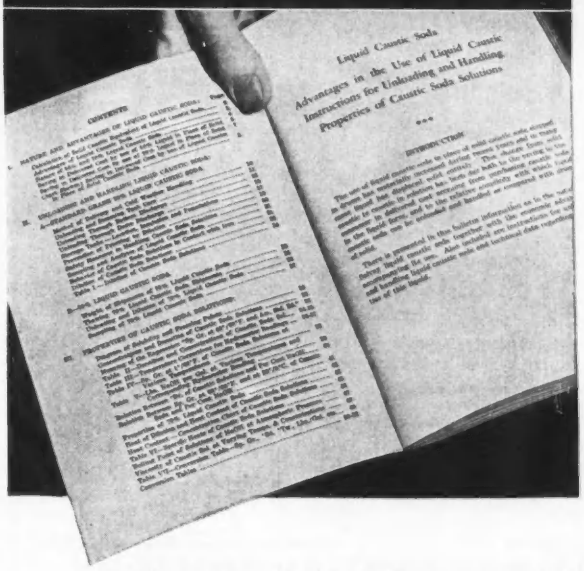
Liquid Caustic Soda
Advantages in the Use of Liquid Caustic
Instructions for Unloading and Handling
Properties of Caustic Soda Solutions
CONTENTS

If you are a technician or plant operator who is now "taking over" an assignment which necessitates a more specific knowledge of Caustic Soda than you previously required, *then write today for Solvay Technical Service Bulletin No. 6.*

This bulletin contains time-saving, factual information from which all sales talk has been eliminated. It is full of important tables, charts and other data on the handling of Caustic Soda. It is information which goes straight to the point... helps you improve efficiency, reduce man hours and increase production speed.

Solvay Technical Service Bulletin No. 6 on Liquid Caustic Soda is one of the series of Solvay Bulletins which are constantly being revised on the basis of new findings. For years this technical literature has had the recognition of plant operators, engineers and scholars who realize that such vital operations data concerning alkalies can only originate out of the breadth of accumulated experience Solvay has gained as America's oldest and largest manufacturer of alkalies.

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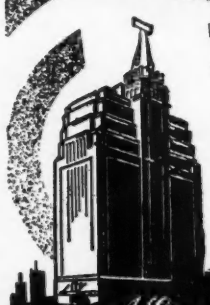

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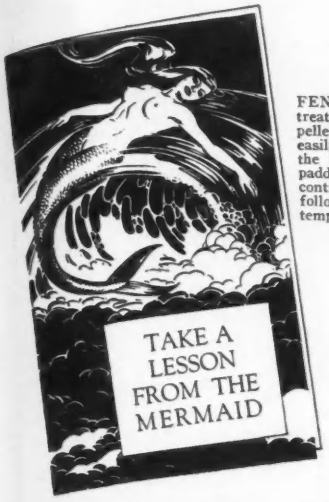

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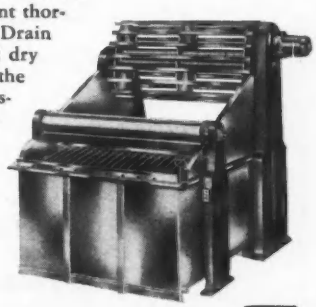

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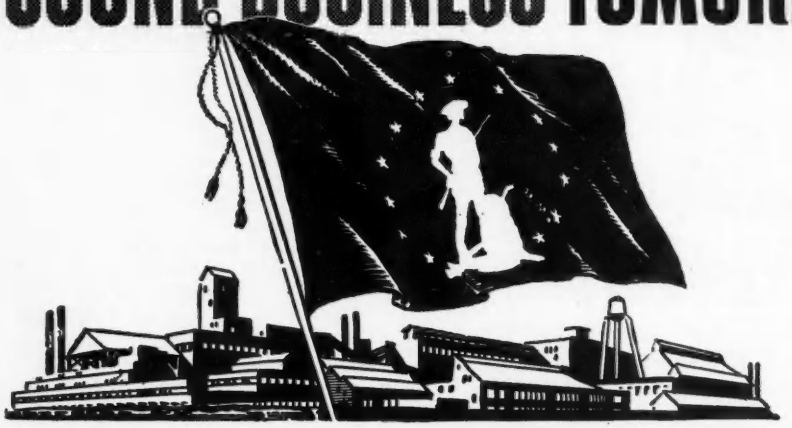

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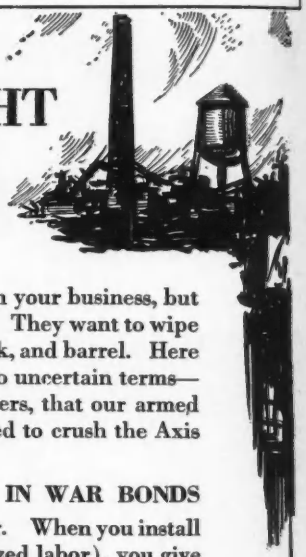

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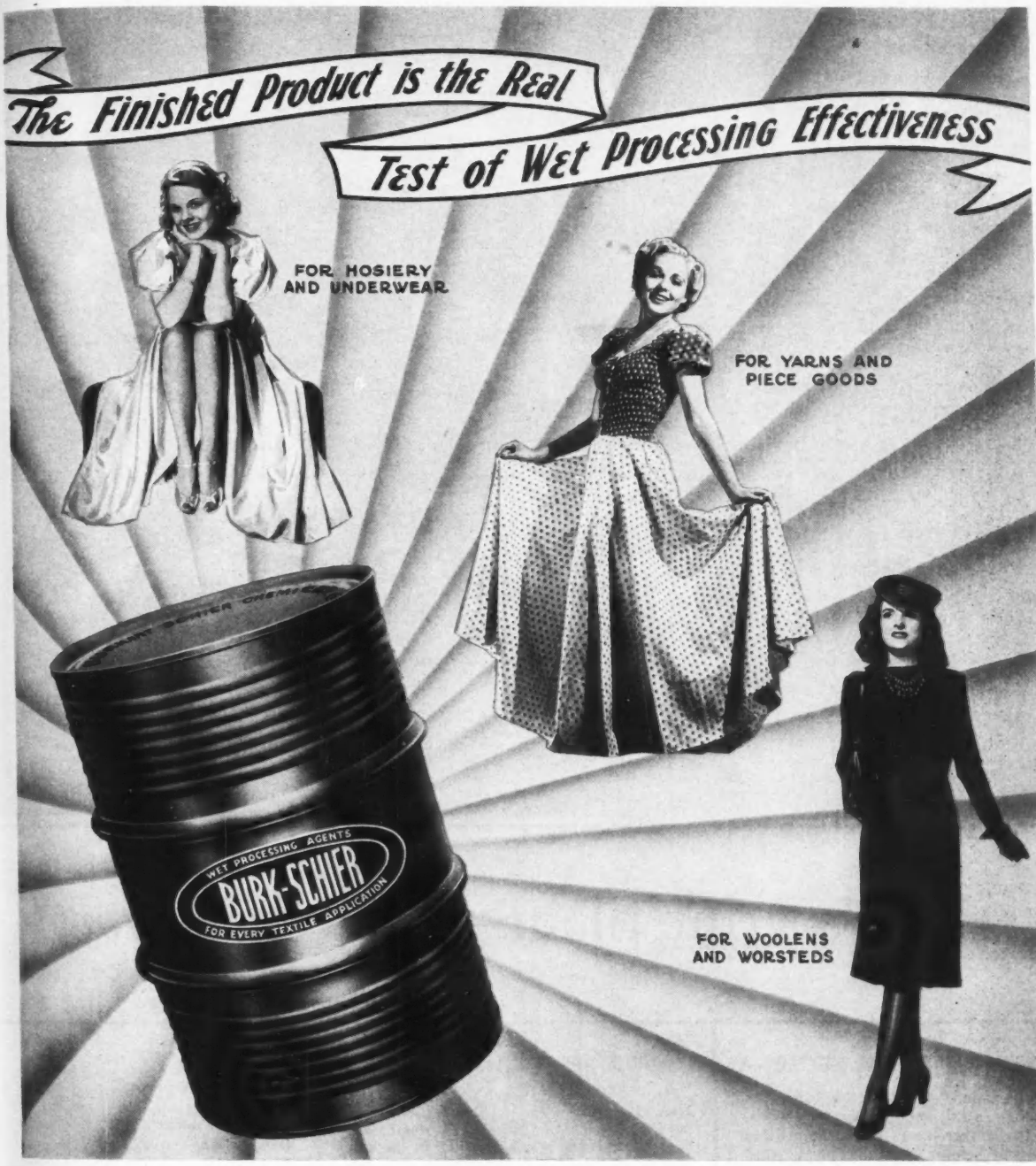
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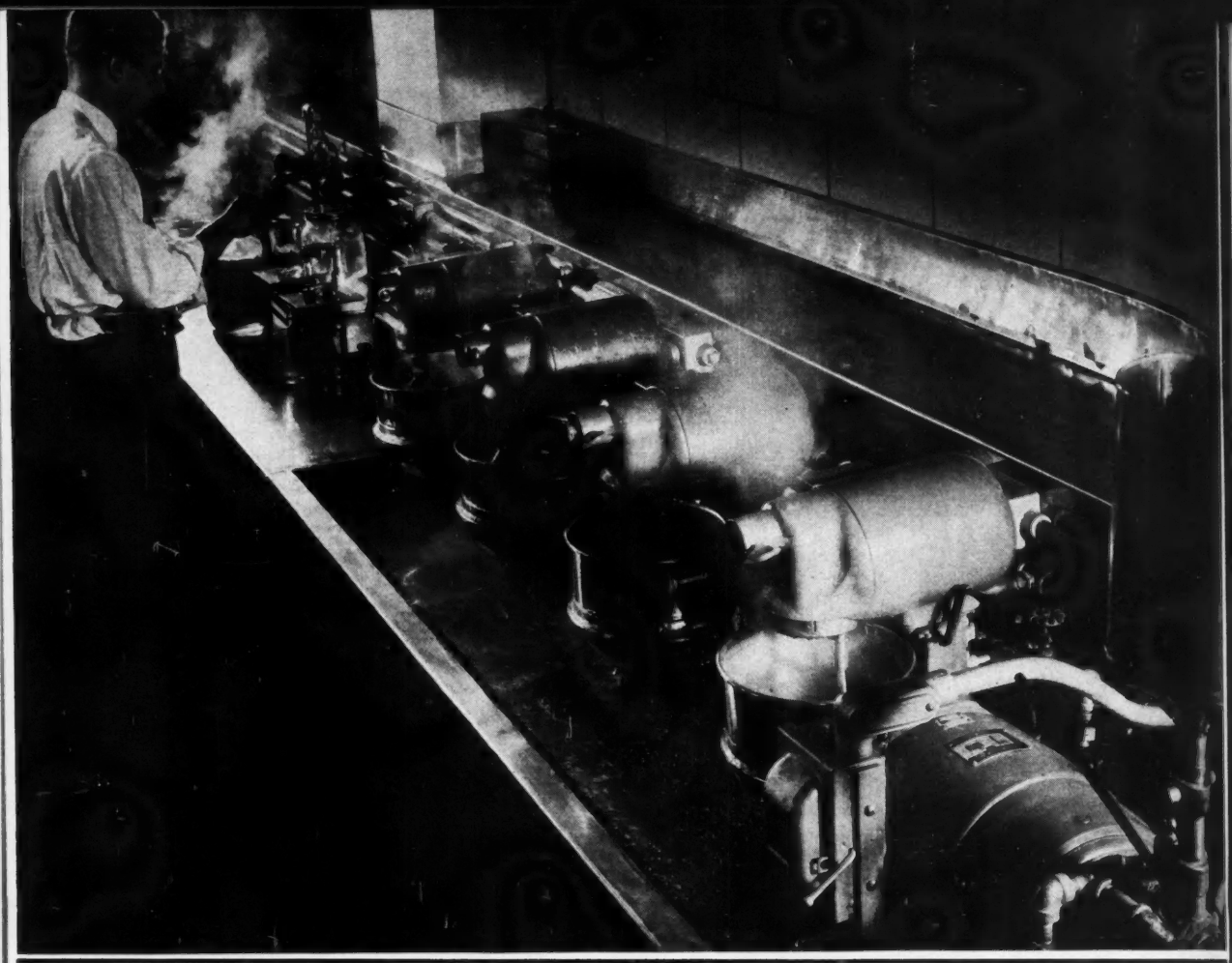

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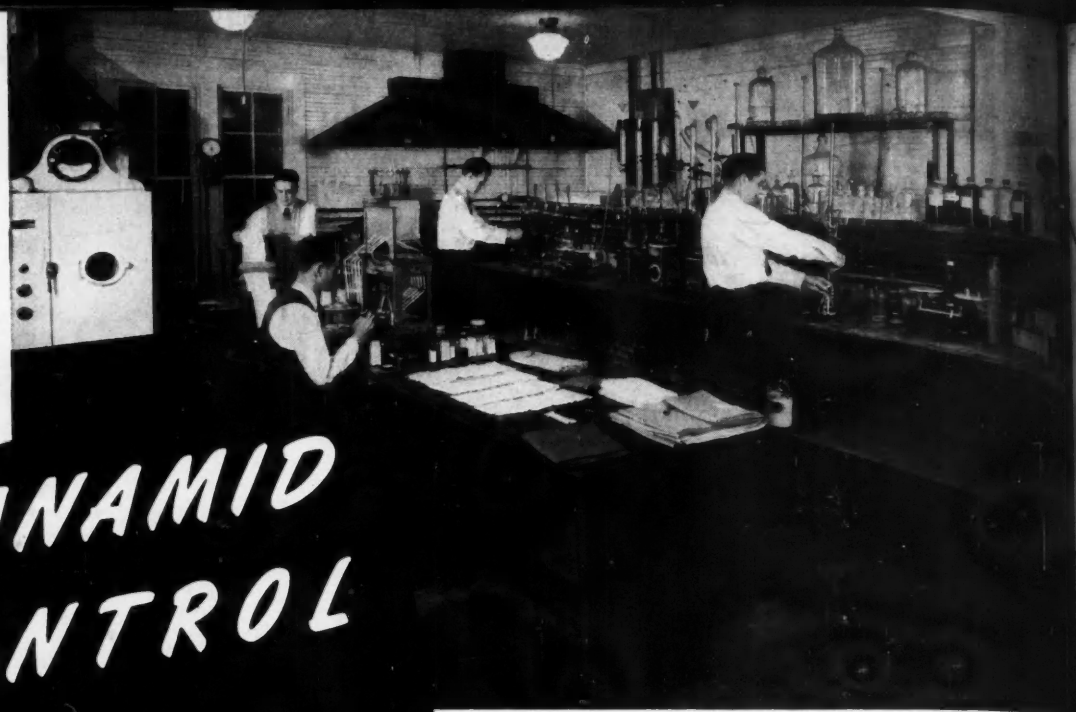

A control laboratory at a Cyanamid plant producing chemicals for textile industry.

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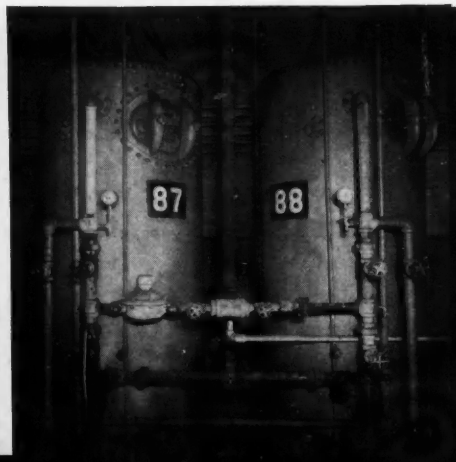

Water is essential to most chemical producing processes. Here is one of the large-capacity water purification units installed in a Cyanamid textile chemical producing plant.

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